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OF THE

AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-SIXTH ANNUAL SESSION,

BOSTON MEDICAL
AUG 12 1891
LIBRARY ASS'N

HELD AT ~~NIAGARA~~ FALLS, N. Y.,

COMMENCING ON THE 3D OF AUGUST, 1886.

PUBLICATION COMMITTEE:

GEO. H. CUSHING. A. W. HARLAN. E. T. DARBY.

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LIST OF OFFICERS FROM DATE OF ORGANIZATION.

PRELIMINARY CONVENTION, NIAGARA FALLS, AUGUST, 1859.

President,	W. W. ALLPORT . . .	Chicago.
Secretary,	J. TAFT	Cincinnati.

ORGANIZATION AND FIRST SESSION OF ASSOCIATION, WASHINGTON, D. C., JULY, 1860.

[Annual meetings to be hereafter last Tuesday in July.]

President,	W. H. ATKINSON . . .	Cleveland.
1st Vice-President,	J. B. GIBBS	Washington, D. C.
2d Vice-President,	W. CAHOON	Detroit, Mich.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	W. MUIR ROGERS . . .	Shelbyville, Ky.
Treasurer,	S. DILLINGHAM . . .	Philadelphia.

[NO MEETING IN 1861.]

CLEVELAND, JULY, 1862.

President,	GEO. WATT	Xenia, Ohio.
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2d Vice-President,	W. D. STONE	Lexington, Ky.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	J. F. JOHNSTON . . .	Indianapolis.
Treasurer,	W. A. PEASE	Dayton, Ohio.

PHILADELPHIA, JULY, 1863.

President,	W. H. ALLEN . . .	New York City.
1st Vice-President,	J. H. MCQUILLEN . . .	Philadelphia.
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Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	C. R. BUTLER . . .	Cleveland.
Treasurer,	A. C. HAWES	New York City.

NIAGARA FALLS, JULY, 1864.

President,	J. H. MCQUILLEN . . .	Philadelphia.
1st Vice-President,	C. P. FITCH	New York City.
2d Vice-President,	H. BENEDICT	Detroit.
Recording Secretary,	J. TAFT	Cincinnati.
Corresponding Secretary,	GEO. W. ELLIS . . .	Philadelphia.
Treasurer,	I. J. WETHERBEE . . .	Boston.

Chicago, July, 1865.

President,	C. W. Spalding	St. Louis.
1st Vice-President,	Geo. H. Cushing	Chicago.
2d Vice-President,	Jas. McManus	Hartford.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	L. D. Shepard	Boston.
Treasurer,	I. J. Wetherbee	Boston.

Boston, July, 1866.

President,	C. P. Fitch	New York City.
1st Vice-President,	W. H. Morgan	Nashville.
2d Vice-President,	L. D. Shepard	Boston.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	A. Hill	Norwalk, Conn.
Treasurer,	W. W. Sheffield	New London, Conn.

Cincinnati, July, 1867.

President,	A. Lawrence	Lowell, Mass.
1st Vice-President,	P. G. C. Hunt	Indianapolis, Ind.
2d Vice-President,	A. S. Talbert	Lexington, Ky.
Recording Secretary,	J. Taft	Cincinnati.
Corresponding Secretary,	C. R. Butler	Cleveland.
Treasurer,	W. H. Goddard	Louisville, Ky.

Niagara Falls, July, 1868.

President,	Jonathan Taft	Cincinnati.
1st Vice-President,	Homer Judd	St. Louis.
2d Vice-President,	A. A. Blount	Springfield, Ohio.
Recording Secretary,	Edgar Park	St. Louis.
Corresponding Secretary,	Jas. McManus	Hartford.
Treasurer,	W. H. Goddard	Louisville.

Saratoga Springs, August, 1869.*

President,	Homer Judd	St. Louis.
1st Vice-President,	S. J. Cobb	Nashville.
2d Vice-President,	C. E. Francis	New York City.
Recording Secretary,	M. S. Dean	Chicago.
Corresponding Secretary,	I. A. Salmon	Boston.
Treasurer,	W. H. Goddard	Louisville.

* Owing to a change in the Constitution, officers elected at this and the sessions following served at the next annual meeting subsequent to their election; and the sessions of and after 1869 commenced on the first Tuesday in August.

NASHVILLE, AUGUST, 1870.

President,	W. H. MORGAN	Nashville.
1st Vice-President,	S. W. DENNIS	San Francisco.
2d Vice-President,	J. R. WALKER	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON	Boston.
Treasurer,	W. H. GODDARD	Louisville.

WHITE SULPHUR SPRINGS, VA., AUGUST, 1871.

President,	GEO. H. CUSHING	Chicago.
1st Vice-President,	C. E. FRANCIS	New York City.
2d Vice-President,	J. R. WALKER	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	I. A. SALMON	Boston.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1872.

President,	P. G. C. HUNT	Indianapolis.
1st Vice-President,	L. D. SHEPARD	Boston.
2d Vice-President,	G. A. MILLS	Brooklyn, N. Y.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	J. TAFT	Cincinnati.
Treasurer,	W. H. GODDARD	Louisville.

PUT-IN-BAY, AUGUST, 1873.

President,	T. L. BUCKINGHAM	Philadelphia.
1st Vice-President,	ISAIAH FORBES	St. Louis.
2d Vice-President,	A. F. MCLAIN	New Orleans.
Recording Secretary,	M. S. DEAN	Chicago.
Corresponding Secretary,	J. TAFT	Cincinnati.
Treasurer,	W. H. GODDARD	Louisville.

DETROIT, AUGUST, 1874.

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Recording Secretary,	C. STODDARD SMITH	Springfield, Ill.
Corresponding Secretary,	GEO. L. FIELD	Detroit.
Treasurer,	W. H. GODDARD	Louisville.

NIAGARA FALLS, AUGUST, 1875.

President,	A. L. NORTHROP	New York City.
1st Vice-President,	H. J. MCKELLOPS	St. Louis.
2d Vice-President,	H. A. SMITH	Cincinnati.
Recording Secretary,	C. STODDARD SMITH	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN	Philadelphia.
Treasurer,	W. H. GODDARD	Louisville.

PHILADELPHIA, AUGUST, 1876.

President,	GEO. W. KEELY . . .	Oxford, Ohio.
1st Vice-President,	C. N. PEIRCE . . .	Philadelphia.
2d Vice-President,	CORYDON PALMER . . .	New York City.
Recording Secretary,	C. STODDARD SMITH . .	Springfield, Ill.
Corresponding Secretary,	J. H. MCQUILLEN . . .	Philadelphia.
Treasurer,	W. H. GODDARD . . .	Louisville.

CHICAGO, AUGUST, 1877.

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2d Vice-President,	GEO. T. BARKER . . .	Philadelphia.
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Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD . . .	Louisville.

NIAGARA FALLS, AUGUST, 1878.

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2d Vice-President,	L. D. CARPENTER . . .	Atlanta, Ga.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. O. RAWLS	Lexington, Ky.
Treasurer,	W. H. GODDARD . . .	Louisville.

NIAGARA FALLS, AUGUST, 1879.

President,	L. D. SHEPARD . . .	Boston.
1st Vice-President,	C. N. PEIRCE . . .	Philadelphia.
2d Vice-President,	GEO. L. FIELD . . .	Detroit.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	M. H. WEBB	Lancaster, Pa.
Treasurer,	W. H. GODDARD . . .	Louisville.

BOSTON, AUGUST, 1880.

President,	C. N. PEIRCE	Philadelphia.
1st Vice-President,	W. C. BARRETT . . .	Buffalo.
2d Vice-President,	GTO. J. FRIEDRICHS . .	New Orleans.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. M. DUDLEY . . .	Salem, Mass.
Treasurer,	W. H. GODDARD . . .	Louisville.

NEW YORK, JULY, 1881.

President,	H. A. SMITH	Cincinnati.
1st Vice-President,	W. C. BARRETT . . .	Buffalo.
2d Vice-President,	GEO. J. FRIEDRICHS . .	New Orleans.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. M. DUDLEY . . .	Salem, Mass.
Treasurer,	W. H. GODDARD . . .	Louisville.

CINCINNATI, AUGUST, 1882.

President,	W. H. GODDARD . . .	Louisville.
1st Vice-President,	GEO. J. FRIEDRICHS . .	New Orleans.
2d Vice-President,	E. T. DARBY	Philadelphia.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

NIAGARA FALLS, AUGUST, 1883.

President,	E. T. DARBY	Philadelphia.
1st Vice-President,	C. S. STOCKTON . . .	Newark, N. J.
2d Vice-President,	T. T. MOORE	Columbia, S. C.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

SARATOGA SPRINGS, AUGUST, 1884.

President,	J. N. CROUSE	Chicago.
1st Vice-President,	M. W. FOSTER . . .	Baltimore.
2d Vice-President,	C. F. RICH	Saratoga.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

MINNEAPOLIS, AUGUST, 1885.

President,	W. C. BARRETT . . .	Buffalo, N. Y.
1st Vice-President,	L. C. INGERSOLL . . .	Keokuk, Iowa.
2d Vice-President,	A. T. SMITH	Minneapolis, Minn.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago, Ill.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago, Ill.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

NIAGARA FALLS, 1886.

President,	W. W. ALLPORT . . .	Chicago, Ill.
1st Vice-President,	GEO. W. MCELHANEY . .	Columbus, Ga.
2d Vice-President,	S. W. DENNIS . . .	San Francisco, Cal.
Recording Secretary,	GEO. H. CUSHING . . .	Chicago, Ill.
Corresponding Secretary,	A. W. HARLAN . . .	Chicago, Ill.
Treasurer,	GEO. W. KEELY . . .	Oxford, Ohio.

EXECUTIVE COMMITTEE FOR SESSION OF 1887.

A. W. HARLAN, Chairman. S. H. GUILFORD, Secretary.

FIRST DIVISION—COMMITTEE OF ARRANGEMENTS.

W. C. WARDLAW, *A. W. HARLAN, *L. D. SHEPARD.

SECOND DIVISION—ON CREDENTIALS, ETHICS, AND AUDITING ACCOUNTS.

*A. O. HUNT, S. G. PERRY, A. H. THOMPSON.

THIRD DIVISION—ON VOLUNTARY ESSAYS.

S. H. GUILFORD, E. T. DARBY, A. M. DUDLEY.

LOCAL COMMITTEE OF ARRANGEMENTS.

THOS. T. MOORE, Columbia, S. C.; M. A. BLAND, Charlotte, N. C.; and B. H. DOUGLASS, Asheville, N. C.

*These go out August, 1887.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1886.

BY GEORGE H. CUSHING, SECRETARY.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Twenty-sixth Annual Session in the Park Theatre, Niagara Falls, N. Y., on Tuesday, August 3, 1886, at 11 o'clock A. M., the President, W. C. Barrett, in the chair.

The roll of members was called, and the following were found either to be present or to have forwarded their dues:

ATKINSON, W. H.	41 East Ninth st., New York.
ABBOTT, FRANK	22 West Fortieth st., New York.
ALLPORT, W. W.	242 Wabash ave., Chicago, Ill.
AMES, W. B.	516 Pullman Bldg, Chicago, Ill.
AUSTIN, J. F.	125 State st., Chicago, Ill.
ABBOTT, J. T.	Manchester, Iowa.
ALLEN, JOHN	7 West Thirty-third st., New York.
BISHOP, J. ADAMS	32 West Thirty-sixth st., New York.
BÖDECKER, C. F. W.	60 East Fifty-eighth st., New York.
BROWN, S. B.	Fort Wayne, Indiana.
BARRETT, W. C.	208 Franklin st., Buffalo, N. Y.
* BUTLER, C. R.	519 Euclid ave., Cleveland, Ohio.
* BAIRD, W. H.	Burlington, Iowa.
BAUER, JOSEPH	130 Esplanade st., New Orleans, La.
BROWN, E. PARMLY	Flushing, Long Island, N. Y.
BOICE, ALONZO	1612 Vine st., Philadelphia, Pa.

* Those marked thus were absent, but sent their dues.

d Those marked thus were delegates, but not permanent members.

BROPHY, TRUMAN W.	125 State st., Chicago, Ill.
*BALDWIN, A. E.	828 North Adams st., Chicago, Ill.
*BARKER, CHARLES C.	10 West Main st., Meriden, Conn.
BAILEY, C. M.	208 Central ave., Minneapolis, Minn.
*BUCKNER, M. L. S.	Shelbyville, Ky.
*BROWN, GEO. V. I.	St. Paul, Minn.
*BROWN, A. E.	1536 Wabash ave., Chicago, Ill.
*BELL, J. R.	55 Euclid ave., Cleveland, Ohio.
*BRACKETT, C. A.	102 Touro st., Newport, R. I.
BOGUE, E. A.	29 East Twentieth st., New York.
*BULLOCK, CHARLES	569 Main st., Cambridgeport, Mass.
*BROCKWAY, A. H.	13 Greene ave., Brooklyn, N. Y.
BALCOM, L.	95 Pine st., Lockport, N. Y.
BARNES, HENRY	74 Public Square, Cleveland, Ohio.
BUTLER, CHARLES S.	263 Main st., Buffalo, N. Y.
CUSHING, GEORGE H.	84 Monroe st., Chicago, Ill.
CROUSE, J. N.	2231 Prairie ave., Chicago, Ill.
*CHAIM, M. L.	18 Cooper Union, New York.
*CLELAND, JAMES	81 State st., Detroit, Mich.
CARR, WILLIAM	85 West Forty-seventh st., New York.
CASE, C. S.	Jackson, Mich.
COOK, C. D.	133 Pacific st., Brooklyn, N. Y.
COWIE, HENRY	Detroit, Mich.
*COLTON, A.	Hudson, N. Y.
CLAWSON, F. W.	Detroit, Mich.
CADY, E. E.	52 Thirty-first st., Chicago, Ill.
CURTIS, G. L.	Syracuse, N. Y.
*CHITTENDEN, CHAS. C.	Madison, Wis.
*CLIFTON, W. R.	Waco, Tex.
*CLEMENT, C. W.	Manchester, N. H.
DENNIS, S. W.	530 Sutter st., San Francisco.
DARBY, E. T.	1513 Walnut st., Philadelphia, Pa.
DAVENPORT, L. C.	Moorhead, Minn.
DOYLE, B. OSCAR	735 Jefferson st., Louisville, Ky.
*DICKINSON, W. P.	Dubuque, Iowa.
DORRANCE, W. H.	Ann Arbor, Mich.
*DOUD, A.	Fort Scott, Kansas.
DOWNS, E. D.	Owego, N. Y.
*DYER, W. C.	2512 Wabash ave., Chicago, Ill.
*DEVORE, J. H.	Corry, Pa.
*DUTCH, WILLIAM	24 Montgomery st., San Francisco, Cal.
*DOUGLASS, B.	Appleton, Wis.
*DUDLEY, ALBION M.	Salem, Mass.
*DAVIS, L. L.	524 West Van Buren st., Chicago, Ill.
*EMMINGER, A. F.	Columbus, Ohio.
FREEMAN, S. A.	14 Court st., Buffalo, N. Y.
FARRAR, J. N.	Apartment No. 1 Rensselaer, cor. Broadway and Thirty-second st., N. Y.

FUNDENBURG, W. H.	823 Penn ave., Pittsburg, Pa.
FIELD, GEORGE L.	Detroit, Mich.
FRIEDRICHS, G. J.	155 St. Charles st., New Orleans, La.
*FREEMAN, A. W.	N. W. cor. State and Madison sts., Chicago, Ill.
FILLEBROWN, THOMAS	Portland, Me.
FULLER, A. H.	2626 Washington ave., St. Louis, Mo.
FUNDENBURG, W. F.	958 Penn ave., Pittsburg, Pa.
FERNANDEZ, E. M. S.	108 State st., Chicago, Ill.
*FINLEY, M. F.	1929 Pennsylvania ave., Washington City, D. C.
GUILFORD, S. H.	1518 Walnut st., Philadelphia, Pa.
GAYLORD, E. S.	New Haven, Conn.
GARDINER, FRANK H.	126 State st., Chicago, Ill.
GILMER, T. L.	Quincy, Ill.
*GRAVES, E. L.	559 W. Madison st., Chicago, Ill.
*GUFFIN, E. L.	125 State st., Chicago, Ill.
GROVE, WM. V.	844 Main st., Buffalo, N. Y.
HAWES, E. P.	Providence, R. I.
*HOYSRADT, G. W.	Ithaca, N. Y.
*HOLMES, E. S.	Grand Rapids, Mich.
HOOPER, J.	644 Fourth ave., Louisville, Ky.
HARLAN, A. W.	70 Dearborn st., Chicago, Ill.
HONSINGER, E.	818 Park ave., Chicago, Ill.
HOW, W. STORER	Chestnut st., cor. 12th, Philadelphia, Pa.
HUNT, A. O.	Iowa City, Iowa.
HORTON, W. P.	177 Euclid ave., Cleveland, Ohio.
*HILL, S. J.	Fargo, Dakota.
HASKELL, L. P.	125 State st., Chicago, Ill.
HEWITT, C. B.	Kansas City, Mo.
*HOWE, A. O.	Washington C. H., Ohio.
HARROUN, C. H.	Toledo, Ohio.
*HAYWARD, T. T.	Minneapolis, Minn.
HAYES, W. CARLOS	Albion, N. Y.
HERTZ, WALTER W.	8 West Third st., Williamsport, Pa.
*HACKER, T. S.	Indianapolis, Ind.
*HORNE, R. F.	Watertown, Mass.
INGERSOLL, L. C.	Keokuk, Iowa.
JACKSON, H. H.	317 Jefferson ave., Detroit, Mich.
JACKSON, V. H.	6 East One Hundredth st., New York.
*JENISON, M. G.	Minneapolis, Minn.
*JEFFERIS, C. R.	Wilmington, Del.
JOHNSON, C. N.	Opera House, Chicago, Ill.
KEELY, GEORGE W.	Cor. High and Main sts., Oxford, Ohio.
*KEELY, CHARLES I.	Cor. High and Third sts., Hamilton, Ohio.
*KINGSBURY, C. A.	1119 Walnut st., Philadelphia, Pa.
*KEITH, H. H.	1515 Washington ave., St. Louis, Mo.
*KULP, J. S.	Muscatine, Iowa.

*Kelley, D. E.	Ashtabula, Ohio.
*Knowles, Saml. E.	S. E. cor. Post and Dupont sts., San Francisco, Cal.
d. Kingsley, Norman W.	25 West Twenty-seventh st., New York.
*Knepper, G.	Marshalltown, Iowa.
*Keech, E. P.	Baltimore, Md.
Kells, C. Edmund, Jr.	12 Dauphin st., New Orleans, La.
Knapp, J. Rollo	103 Canal st., New Orleans, La.
Lathrop, Joseph	152 Woodward ave., Detroit, Mich.
Lyon, L. W.	Ryan Hotel, St. Paul, Minn.
Ludwig, R. F.	125 State st., Chicago, Ill.
Levy, Fred. A.	Orange, N. J.
Lewis, W. F.	136 Wisconsin st., Milwaukee, Wis.
Lewis, C. W.	445 North Clark st., Chicago, Ill.
d. Lathrop, H. K., Jr.	Detroit, Mich.
*Leiter, Thos. C.	Wadsworth, Ohio.
*Litch, Wilbur F.	1627 Chestnut st., Philadelphia, Pa.
Land, C. H.	246 Woodward st., Detroit, Mich.
McElhaney, G. W.	Columbus, Ga.
*Morrison, W. N.	1337 Washington ave., St. Louis, Mo.
McManus, James	Hartford, Conn.
McKellops, H. J.	2630 Washington ave., St. Louis, Mo.
Moore, E. C.	27 Lafayette ave., Detroit, Mich.
*Moore, T. T.	Columbia, S. C.
*Maercklein, B. G.	Iron Block, Milwaukee, Wis.
Marshall, John S.	242 Wabash ave., Chicago, Ill.
Morgan, W. H.	Nashville, Tenn.
Martin, W. J.	181 W. Madison st., Chicago, Ill.
Martindale, J. H.	414 Nicollet ave., Minneapolis, Minn.
*Moore, S. J.	Mitchell, Dakota.
McMillen, D. J.	720 Main st., Kansas City, Mo.
*Maercklein, Robt.	Iron Block, Milwaukee, Wis.
*Morgan, Henry W.	Nashville, Tenn.
Melotte, Geo. W.	Ithaca, N. Y.
Moore, H. L.	276 Race st., Cincinnati, Ohio.
d. Metcalf, A. T.	Kalamazoo, Mich.
d. Mullett, Eugene R.	Clinton, Iowa.
*Noble, H. B.	600 Thirteenth st., Washington, D. C.
*Northrop, A. L.	57 West Forty-ninth st., New York.
*Noyes, Edmund	65 Randolph st., Chicago, Ill.
*Newby, Jas. B.	2640 Washington ave., St. Louis, Mo.
*Nickson, E. D.	Humboldt, Iowa.
Odell, F. M.	7 West Thirty-eighth st., New York.
Ottofy, Louis	1228 Milwaukee ave., Chicago, Ill.
Perry, S. G.	46 West Thirty-seventh st., New York.
*Palmer, J. W.	Fitchburg, Mass.
Peirce, C. N.	1415 Walnut st., Philadelphia, Pa.
*Page, W. E.	Room 11, Studio Building, Boston, Mass.

*Patterson, J. D.	S. W. cor. Eighth and Main sts., Kansas City, Mo.
*Pruyn, Charles P.	70 Dearborn st., Chicago, Ill.
*Patrick, John J. R.	Belleville, Ill.
*Peterson, C. J.	Dubuque, Iowa.
Prosser, A. J.	1605 Olive st., St. Louis, Mo.
*Priest, A. N.	Utica, N. Y.
Palmer, Edgar	La Crosse, Wis.
*Peterson, Denton E.	Shanghai, China.
Rehwinkel, F. H.	Chillicothe, Ohio.
*Rhone, J. W.	Bellefonte, Pa.
*Rhein, M. L.	104 East Fifty-eighth st., New York.
*Richter, R. G.	128 Wisconsin st., Milwaukee, Wis.
*Reid, J. G.	80 McCormick Block, Chicago, Ill.
*Reid, H. M.	252 Nicollet ave., Minneapolis, Minn.
Roberts, Norman J.	Waukegan, Ill.
Remington, F. A.	57 West Forty-ninth st., New York.
*Stevens, S. G.	Evans House, 175 Tremont st., Boston, Mass.
*Smith, Eugene H.	283 Dartmouth st., Boston, Mass.
*Starbuck, W. C.	Jamaica Plain, Mass.
Smith, H. A.	128 Garfield Place, Cincinnati, Ohio.
*Shepard, L. D.	100 Boylston st., Boston, Mass.
*Stockton, C. S.	Newark, N. J.
*Swain, E. D.	65 Randolph st., Chicago, Ill.
Swasey, J. A.	3003 Michigan ave., Chicago, Ill.
Smith, A. T.,	258 First ave., Minneapolis, Minn.
Stewart, W. C.	Elmira, N. Y.
*Shirley, W. M.	Hiawatha, Kansas.
Southwell, C. C.	110 Wisconsin st., Milwaukee, Wis.
Southwell, C. P.	304 Grand ave., Milwaukee, Wis.
Spaulding, W. A.	506½ Nicollet ave., Minneapolis, Minn.
Sitherwood, Geo. D.	118 Washington st., Bloomington, Ill.
*Smith, J. H.	New Haven, Conn.
Starr, A. R.	164 East Ninety-first st., New York.
Smith, Marvin E.	163 State st., Chicago, Ill.
Straight, Milton B.	485 Main st., Buffalo, N.Y.
*Toledo, M. V.	113 East Eighteenth st., New York.
*Thomas, G. R.	Detroit, Mich.
Taft, J.	122 West Seventh st., Cincinnati, Ohio.
*Trueman, W. H.	900 Spruce st., Philadelphia, Pa.
Timme, C. A.	170 Hudson st., Hoboken, N. J.
Thompson, A. H.	Topeka, Kansas.
Talbot, Eugene S.	125 State st., Chicago, Ill.
d. Truman, James	8249 Chesnut st., Philadelphia, Pa.
*Viet, Martin	12 Dauphin st., New Orleans, La.
*Van Valzah, Robert	401½ Main st., Terre Haute, Ind.
Van De Water, I. N.	Madison, N. J.

WHITE, SAML. A.	Savannah, Ga.
WATLING, J. A.	Ypsilanti, Mich.
* WENDELL, W. C. . . .	Iron Block, Milwaukee.
WATKINS, S. C. G. . . .	Mont Clair, N. J.
* WADSWORTH, T. A. . . .	159 W. Thirty-fourth st., New York.
WALKER, WILLIAM WALLACE .	67 W. Ninth st., New York.
WALTON, J. C.	Howell, Mich.
WASSALL, J. W.	208 Dearborn ave., Chicago, Ill.
WATERS, T. S.	Baltimore, Md.
WELCH, JAMES M. . . .	St. Paul, Minn.
* WHITSLAR, W. H. . . .	Youngstown, Ohio.
* WEEKS, THOS. E. . . .	301 Nicollet ave., Minneapolis, Minn.
WINDER, R. B.	140 Park ave., Baltimore, Md.
* WILLIAMS, J. B. . . .	Fox Lake, Wis.
* WILLIAMSON, F. A. . . .	Red Wing, Minn.
* WATERS, GEO. F. . . .	8 Beacon st., Boston, Mass.
* WILSON, I. P.	317 N. Fourth st., Burlington, Iowa.
WHITSLAR, F. S.	Youngstown, Ohio.
WARDLAW, W. C.	Augusta, Ga.
* WADSWORTH, E. CLIFFORD .	53 Bedford ave., Brooklyn, N. Y.

Any inaccuracies in the above list, in name or location, should be reported to the Treasurer at once, in order that the necessary correction may be made.

Annual dues being payable in advance, no name appears on above list except of those who have paid for 1886, and Transactions are not sent to any who have not fully paid their dues.

Do not send *personal check* when remitting dues. Dues must be paid to the Treasurer.

On motion the reading of the minutes was dispensed with.

The consideration of proposed amendments to the Constitution, offered last year, was then entered into.

The following, proposed by Dr. T. T. Moore, viz.:

"To amend Article IV of the Constitution by striking out the word 'first' in the third line and inserting in lieu thereof the word 'fourth,' making the article read fourth Tuesday instead of first Tuesday in August,"

was on motion laid on the table.

The following, proposed by Dr. C. N. Peirce, viz.:

To amend Article IV, page 9, by striking out these words, "The place of meeting shall be determined each year by vote of the Association," and inserting in their place the following:

"The place of meeting shall be determined each year by the Executive Committee, and notice of the selection made announced to the members of the Association through the dental journals not later than the first of March preceding the annual meeting."

was on Dr. Peirce's motion indefinitely postponed.

The following, proposed by Dr. A. H. Thompson, was then considered, viz.:

To amend Section 2 of Article VI by substituting the following, viz.:

"SECTION 2. It shall be the duty of each permanent member to identify himself with one or more of the above named Sections, and he shall inform the Recording Secretary of his choice at the time of joining the Association. At the close of the morning session of the second day of the annual meeting, the roll of members in good standing shall be called for the annual reorganization of the Sections, and each member shall answer to his name by announcing his choice of Sections. The Sections may, by permission of the Association, hold separate meetings for the reading of papers and discussions, and report the same in abstract to the full meeting of the Association."

It was moved that it be adopted.

Discussed by Drs. Thompson, Fillebrown, Truman, Crouse, Dorrance, Haskell, Marshall, Cushing, and Allport. On motion it was laid on the table.

The Executive Committee reported the printed programme as their report thus far. It was accepted and adopted.

The Publication Committee submitted the following report, which was referred to the Auditing Committee:

NIAGARA FALLS, August 3, 1886.

The Publication Committee would report that the Transactions were published under the same arrangement with The S. S. White Dental Manufacturing Co. that has for some years prevailed, and consequently without cost to the Association.

The work has been—as always—admirably done, and the careful assistance of Mr. Hise has again placed the committee and the Association under obligations to him.

The usual number of copies were printed, and most of them bound in cloth in pursuance of the instructions issued last year. There are on hand about seventy-five copies.

The distribution was made as heretofore to all active members whose dues were paid, and to the various libraries, universities, journals, and honorary members entitled to receive them.

The committee were enabled through favoring circumstances and hard work to mail them December 9, 1885, a much earlier date of distribution than it has been possible to effect for many previous years.

Your committee has also had made two copies in manuscript of the entire Transactions for the year 1863, in order to complete the series in the Medical Library at Washington, and the library of the Chicago Historical Society.

Following their instructions, they caused the memorials to the late Isaiah Forbes, of St. Louis, and J. G. Ambler, of New York City, to be properly engrossed and forwarded to their families.

RECEIPTS AND EXPENDITURES.

Received from Treasurer...	$90 00	
" " sale of Transactions...	8 00	
		$98 00
Expended for expressage, paper, and copying...	$14 70	
" " copying 2 vols. Transactions...	12 00	
" " printing postal cards...	5 50	
" " S. S. White Dental Manufacturing Co.'s bill for cloth binding and mailing...	59 57	
" " engrossing memorials...	12 00	
" " postage and incidentals...	15 68	
		$119 40
Balance due the Committee...		$21 40

All of which is respectfully submitted.

GEO. H. CUSHING, *Chairman.*

Audited and found correct.

A. O. HUNT,
S. G. PERRY,
LOUIS OTTOFY, } *Auditing Committee.*

By consent Dr. A. T. Metcalf, of Kalamazoo, was allowed to state his objections to paying back dues.

After some discussion the matter was referred to the Committee on Credentials.

The Treasurer offered the following report, which was referred to the Auditing Committee:

NIAGARA FALLS, N. Y., August 8, 1886.

THE AMERICAN DENTAL ASSOCIATION IN ACCOUNT WITH GEO. W. KEELY, TREASURER.

	CR.
By balance Aug. 4, 1885...	$1,948.95
From W. R. Clifton...	200.00
Dues received at Minneapolis...	1,020.00
" " since last meeting...	240.00
	$3,408.95

DISBURSEMENTS.

	Dr.	
A. W. Harlan, postage, envelopes, etc	$12.50	
Secretary's salary	200.00	
Treasurer's "	100.00	
Reporter's "	125.00	
Balance due Publishing Committee	9.66	
Use of hall 4 days, $50.00; do. elevator, $6.00	56.00	
Treasurer's expenses, postage, express, etc	9.89	
J. N. Crouse, Chairman Committee on Arrangements	41.90	
C. N. Peirce, postal cards and other expense	18.50	
J. N. Crouse, 6,000 four-page circulars and 400 certificates	87.50	
A. T. Smith, carpets and matting and expense for clinics	89.80	
G. H. Cushing, mounting and engraving gavel	19.00	
" for S. S. White Mfg. Co., and for incidentals	95.00	
A. H. Thompson, procuring investigation, Section VII	25.00	
Paid elevator boy	5.00	
" for printing cards	1.25	
		$790.50
Balance on hand		$2,618.45

Audited and approved, Aug. 4, 1886.

A. O. HUNT,
LOUIS OTTOFY,
S. G. PERRY,
} *Committee.*

The Sections then announced the time and place for their meetings.

The President then read the Annual Address, which was referred to the Publication Committee.

On motion, adjourned to meet at 8 P. M.

FIRST DAY—EVENING SESSION.

The Association was called to order at 8.30 P. M., the President, Dr. Barrett, being in the chair.

The minutes of the morning session were read and approved.

Under the head of miscellaneous business, Dr. Thompson called up the amendment to the Constitution proposed by him, which was laid on the table this morning.

On motion it was adopted after some verbal changes, as follows:

Amend Section 2 of Article VI of the Constitution by substituting in its place the following, viz.:

"SECTION 2. It shall be the duty of each member to identify himself with one or more of the above named Sections, and he shall inform the Recording Secretary of his choice at the time of joining the Association. At the close of the morning session of the second day of the annual meeting the roll of permanent members in good standing shall be called for the annual reorganization of the Sections."

The Sections were then called in order, commencing with Section I, when it was found that no Section was ready to report till Section VII was reached.

The secretary of Section VII read the following:

Section VII reports the following papers:

By W. Storer How—Preliminary Notice of Methods of Investigating Oral Fluids with Reference to the Etiology of Dental Caries.

By A. H. Thompson—Protoplasmic Nutrition and Molecular Metamorphosis in the Dental Tissues.

By H. A. Smith—Diseases of the Tongue.

By A. H. Thompson—Pathological Heredity and Gouty Teeth.

None of the papers being present, Section I was again called, and its report was read by the Secretary, Dr. W. B. Ames, who also offered, in behalf of the Section, a resolution that the report be discussed before other papers in the Section were read. The resolution was lost.

And on motion the other papers presented by the Section were read.

The first by W. H. Trueman, of Philadelphia, was read by the Secretary, Dr. Ames.

Dr. Crouse moved to reconsider the motion to proceed with the reading of the papers. Lost.

Dr. Haskell then read a paper, which was followed by one by Dr. Dorrance.

A motion to adjourn was lost.

Dr. Haskell moved that a committee of three be appointed to confer with manufacturers of mineral teeth, to secure certain ends. Carried, and the Chair appointed Drs. Haskell, Ames, and W. H. Trueman as that committee.

Section I was then discussed by Drs. Peirce, Dorrance, Spaulding, Friedrichs, Ottofy, Cushing, Morgan, Jas. Truman, and Atkinson.

The Committee on Credentials reported that Dr. Metcalf was entitled to come in as a new member.

The report was adopted.

Dr. Rehwinkel moved that the friendly and fraternal greetings of this Association be sent by telegraph to the Central German Dental Association and the American Dental Association of Europe, now in session. Carried.

The Secretary read a communication from the Librarian of the Patent Office Library in London, England, asking for a series of the Transactions of this Association.

On motion, he was instructed to forward as complete a series as possible.

Adjourned to meet at 9 A. M. to-morrow.

SECOND DAY—MORNING SESSION.

The Association met at 9.30 A. M., the President, Dr. Barrett, in the chair.

The minutes of last evening's session were read and approved.

Under the head of miscellaneous business, Dr. Rehwinkel announced that he had learned that the societies to whom it was voted to send the congratulations of this Association had already adjourned, and consequently the telegrams had not been forwarded.

The Committee on Credentials made a partial report, which was adopted, and which was subsequently completed, as follows:

Baltimore College of Dental Surgery—R. B. Winder.
Brooklyn Dental Society—Chas. D. Cook.
California State Odontological Society—S. W. Dennis.
Chicago Dental Society—Geo. H. Cushing, E. E. Cady, Frank H. Gardiner, A. W. Harlan, J. N. Crouse, T. W. Brophy, M. E. Smith, C. N. Johnson, C. W. Lewis.
Chicago Dental Club—E. M. S. Fernandez.

Connecticut Valley Dental Association—E. S. Gaylord.
Eighth District Dental Society of the State of New York—W. V. Grove, L. Balcom, M. B. Straight, W. C. Hayes, Charles S. Butler.
First District Dental Society of the State of New York—Alfred R. Starr, F. A. Remington, A. R. Gage.
Fifth District Dental Society of the State of New York—Geo. L. Curtis.
Georgia State Dental Society—W. C. Wardlaw.
Illinois State Dental Society—N. J. Roberts, W. W. Allport, Louis Ottofy, Jas. A. Swasey.
Indiana State Dental Society—S. B. Brown.
Iowa State Dental Society—A. O. Hunt, L. C. Ingersoll, J. T. Abbott, E. R. Mullett.
Kansas State Dental Association—A. H. Thompson.
Kentucky State Dental Society—E. D. Downs.
Louisiana State Dental Society—J. Rollo Knapp, Jos. Bauer.
Michigan State Dental Society—C. H. Land, A. T. Metcalf, F. W. Clawson, H. K. Lathrop, Jr.
Minneapolis Dental Society—A. T. Smith.
Minneapolis Hospital College—W. A. Spaulding.
Minnesota State Dental Society—Jas. M. Welch.
Mississippi Valley Association of Dental Surgeons—H. L. Moore.
Missouri Dental College—A. H. Fuller.
New Jersey State Dental Society—I. N. Van De Water.
New Orleans Odontological Society—C. Edmund Kells, Jr.
Northern Ohio Dental Association—H. Barnes.
Northwestern Dental Association—L. C. Davenport.
Odontological Society of Pennsylvania—James Truman.
Odontological Society of Western Pennsylvania—F. S. Whitslar.
Pennsylvania State Dental Society—W. F. Fundenburg, Alonzo Boice, S. H. Guilford.
Pittsburg Dental Association—W. H. Fundenburg.
St. Paul Medical College, Dental Department—L. W. Lyon.
Sixth District Dental Society of the State of New York—G. W. Melotte.
Society of the Alumni of the Department of Dentistry of the University of Pennsylvania—G. L. Curtis.
Susquehanna Dental Association—W. W. Hertz.
University of California—S. W. Dennis.
University of Iowa, Dental Department—A. O. Hunt.
Wisconsin State Dental Association—W. F. Lewis, E. Palmer.

The Executive Committee announced the filling of the vacancy on this committee by the appointment of Dr. Louis Ottofy, of Chicago.

Dr. Bödecker then presented to the Association Dr. Wilhelm Herbst, of Bremen, Germany, who was introduced by the President in a few complimentary remarks.

Dr. Herbst (speaking in German), in thanking the Association, said that he had received so many kindly greetings and warm receptions at the hands of the Americans that his feelings could not be expressed in words.

On motion Dr. Bryan, of Switzerland, and the several gentlemen visiting the Association from Canada were tendered the privileges of the floor.

On motion a vote of thanks was tendered to Dr. C. F. W. Bödecker for his efforts in securing the presence of Dr. Herbst in this country and for his trouble in attending him and explaining his methods.

On motion of Dr. Atkinson, Dr. Herbst was made an honorary member of the Association by acclamation.

The discussion of Section I was then resumed, and was participated in by Drs. Horton, John Allen, Kingsley, and Land.

On motion the subject was passed.

Dr. Brophy moved that Section IV, Operative Dentistry, be called in place of Section II.

No objection being offered, the chairman of Section IV read his report.

Some discussion took place as to whether bridge-work belonged in Operative Dentistry or not, paticipated in by Drs. Kingsley, Melotte, Morgan, McKellops, and E. Parmly Brown.

Dr. Taft here rose to a point of order.

The point made was that the subject before the Association was the consideration of the report of Section IV.

The point was sustained.

Dr. Fillebrown moved that Dr. Herbst be invited to address the Association on this subject. Carried.

Dr. Herbst then spoke (in German) upon his methods, his remarks being interpreted by Dr. Bödecker.

The subject was further discussed by Drs. Ottofy, Bödecker, Atkinson, Taft, Marshall, Rehwinkel, Peirce, Watkins, Bryan, of Switzerland; Crouse, Morgan, James Truman, Bogue, Hunt, Perry, Fillebrown, Brophy, Sitherwood, and H. A. Smith.

It now being 1 o'clock, the hour assigned for the organization of Sections, that business was proceeded with, resulting as follows:

SECTION I. Prosthetic Dentistry, Metallurgy, and Chemistry.—C. H. Harronn, chairman; W. B. Ames, secretary; Alonzo Boice, E. Parmly Brown, W. H. Dorrance, S. A. Freeman, L. P. Haskell, J. Rollo Knapp, Geo. W. Melotte, M. B. Straight, Jas. M. Welch, C. S. Case, C. P. Southwell, W. A. Spaulding, Thos. C. Leiter, E. Honsinger, M. L. Chaim, J. W. Rhone, E. M. S. Fernandez, E. H. Allen, C. H. Land, J. Barker Vosburgh, H. H. Keith, D. C. McNaughton, Eben M. Flagg, F. A. Remington, J. H. Baldwin, E. L. Brooks, L. P. Bethel, S. T. Clements, C. W. Clement, E. B. Call, W. H. Crary, Chas. E. Dunn, J. H. Devore, Wm. Dutch, A. W. Freeman, E. L. Graves, E. E. Hughes, J. Hardman, A. O. Howe, H. H. Jackson, J. S. Kulp, Geo. W. Klump, C. A. Kitchen, Henry A. Knight, D. E. Kelley, P. J. Kester, Saml. E. Knowles, A. E. Matteson, J. B. Monfort, G. W. Miller, Geo. H. McCausey, S. J. Moore, D. J. McMillen, Robt. Maercklein, Jas. B. Newby, E. D. Nickson, J. W. Palmer, C. J. Peterson, R. G. Richter, F. R. Ross, H. M. Reid, J. H. Spaulding, W. B. Smith, C. C. Southwell, C. J. Tibbetts, E. S. Talbot, W. C. Wendell, L. C. Wasson, J. B. Williams.

SECTION II. Dental Education, Literature, and Nomenclature.—W. H. Atkinson, chairman; Louis Ottofy, secretary; John Allen, S. B. Brown, J. N. Crouse, Thos. Fillebrown, S. H. Guilford, A. O. Hunt, W. P. Horton, W. H. Morgan, C. N. Peirce, H. A. Smith, L. Balcom, Geo. D. Sitherwood, J. Taft, W. C. Wardlaw, J. N. Farrar, M. V. Toledo, E. S. Holmes, W. O. Kulp, Chas. D. Cook, G. W. McElhaney, E. P. Keech, C. C. Chittenden, Geo. W. Fuller, C. A. Kingsbury, E. A. Bogue, A. L. Northrop, F. H. Rehwinkel.

SECTION III. Operative Dentistry.—E. T. Darby, chairman; H. J. McKellops, secretary; C. F. W. Bödecker, Alonzo Boice, E. Parmly Brown, J. N. Crouse, W. H. Dorrance, Geo. L. Field, Thos. Fillebrown, E. S. Gaylord, Geo. W. Keely, Charles I. Keely, Joseph Lathrop, R. F. Ludwig, C. A. Timme, Samuel A. White, J. C. Walton, J. Rollo Knapp, F. S. Whitslar, Geo. W. Melotte, F. W. Clawson, C. W. Lewis, S. G. Perry, W. W. Hertz, M. B. Straight, James M. Welch, E. E. Cady, Jas. McManus, T. S. Waters, C. N. Johnson, C. P. Southwell, T. B. Wheeler, B. Douglass, T. E. Weeks, H. L. Moore, W. F. Fundenburg, W. E. Page, G. L. Curtis, I. N. Van De Water, L. D. Shepard, W. C. Starbuck, J. R. Bell, W. W. Ormsby, Marvin E. Smith, C. B. Hewitt, A. H. Fuller, A. J. Prosser, Eugene H. Smith, J. W. Rhone, T. T. Hayward, S. G. Stevens, Robert F. Horne, J. T. Abbott, C. S. Butler, Chas. C. Barker, Dwight M. Clapp, G. W. Hoysradt, B. Oscar Doyle, E. C. Wadsworth, L. C. Davenport, Jos. Bauer, B. L. Rhein, J. F. Austin, E. P. Keech, V. H. Jackson, Henry Barnes, E. Noyes, W. F. Lewis, C. H. Land, L. W. Lyon, W. N. Morrison, P. G. C. Hunt, L. K. Fullerton, G. Knepper, W. H. Fundenburg, J. A. Watling, S. B. Palmer, A. N. Priest, Henry W. Morgan, A. B. Cutler, C. S. Stockton, J. G. Reed, H. B. Noble, E. D. Brower, W. P. Dickinson, E. P. Hawes, A. H. Brockway, T. S. Hacker, A. F. Emminger, C. R. Butler, A. E. Brown, W. R. Clifton, James Cleland, W. H. Colgrove, A. Colton, Henry Cowie, G. C. Daboll, Thos. C. Leiter, E. C. Moore, J. A. Swasey, A. T. Smith, J. H. Smith, G. R. Thomas, Martin Viet, N. Nelson, S. C. G. Watkins.

SECTION IV. Histology and Microscopy.—Frank Abbott, chairman; Geo. D. Sitherwood, secretary; W. H. Morgan, A. H. Thompson, L. Balcom, I. P. Wilson, L. L. Davis, A. T. Bigelow, C. Bullock, Ira Brown, S. W. Dennis, W. B. Finney, M. F. Finley, Thos. T. Moore.

SECTION V. Materia Medica and Therapeutics.—A. W. Harlan, chairman; John S. Marshall, secretary; W. W. Allport, Geo. J. Friedrichs, F. H. Gardiner, J. Hooper, L. C. Ingersoll, W. H. Whitslar, T. W. Brophy, R. B. Winder, W. C. Stewart, E. E. Cady, E. D. Downs, C. R. Jefferis, W. C. Hayes, Wilbur F. Litch, C. A. Brackett, F. M. Odell, Charles P. Pruyn, C. M. Bailey, Alfred R. Starr, Wm. J. Martin, G. W. McElhaney, A. M. Dudley, J. G. Reid, A. Doud, W. H. Baird, W. C. Dyer, M. W. Foster, J. Frank Marriner, E. D. Swain, J. A. Swasey, H. J. Smith, I. Williams.

SECTION VI. Physiology and Etiology.—H. A. Smith, chairman; A. H. Thompson, secretary; W. C. Barrett, Geo. J. Friedrichs, W. P. Horton, J. W. Wassall, Louis Ottofy, W. Storer How, J. D. Patterson, Geo. F. Waters, F. A. Williamson, E. L. Guffin, W. M. Shirley, Wm. Carr, C. S. Beck, A. E. Baldwin, A. R. Begun, M. L. S. Buckner, E. B. Dillingham, S. J. Hill, B. G. Maercklein, A. Morsman, Robert Van Valzah, S. C. G. Watkins, T. A. Wadsworth, J. G. W. Werner.

SECTION VII. Anatomy, Pathology, and Surgery.—T. W. Brophy, chairman; J. H. Martindale, secretary; J. W. Wassall, J. S. Marshall, R. B. Winder, J. Hooper, N. J. Roberts, W. W. Walker, E. Palmer, F. H. Gardiner, F. A. Levy, W. C. Barrett, W. B. Ames, Wm. V. Grove, Frank Abbott, T. L. Gilmer, M. G. Jenison, M. L. Rhein, J. Adams Bishop, W. F. Lewis, John J. R. Patrick, W. P. Dickinson, S. H. King.

On motion adjourned till 8 P.M.

SECOND DAY—EVENING SESSION.

The Association was called to order at 8.30 P.M., the President, Dr. Barrett, in the chair.

The minutes of the morning session were read and approved.

No miscellaneous business being presented, the discussion of Section IV was called.

Dr. Abbott moved to pass the subject. Lost.

The subject was then discussed by Drs. Marshall, Brophy, McKellops, Perry, Watkins, and Guilford.

On motion the subject was passed.

Section II being called was not ready to report.

Section III was called and asked for further time, which on motion was granted.

Section V was called and responded through its chairman, Dr. Frank Abbott, after the reading of whose report and paper the Association adjourned to meet at 9 A.M. to-morrow.

THIRD DAY—MORNING SESSION.

The Association met at 9.30 A.M., the President, Dr. Barrett, in the chair.

The minutes of last evening's session were read and approved.

Under the head of miscellaneous business, on motion the Treasurer was instructed to pay all properly authenticated bills.

On motion Section I was called, to present a supplemental report, which was read by its secretary, Dr. W. B. Ames. The report was adopted, and Dr. J. Rollo Knapp, of New Orleans, was requested to describe his methods as referred to in the report just read.

After brief remarks by Dr. Knapp, the subject was discussed by Drs. Kingsley and Frank Abbott, when it was passed.

Miscellaneous business was resumed.

The Committee on Credentials made a further report, which after some discussion was adopted.

The Committee on Voluntary Papers submitted the following report, which was adopted:

The Committee on Voluntary Essays would respectfully report that they have had two papers before them. One they returned to the writer as being incomplete. The other, by Dr. Morsman, on "Amalgam," they recommend be not read, but referred to the Publication Committee, with power to make such selection as in their judgment is of value to the profession and worthy of a place in our proceedings.

C. N. PEIRCE, *Chairman.*

The following, offered by Dr. Ingersoll, was adopted:

It shall be the duty of the Executive Committee of the Association to provide at the opening of each annual meeting a book for the registration of members or visitors as they arrive, which shall also give place of residence and hotel where each may be found.

The regular order was resumed, and Section V was discussed by Drs. Atkinson, Thompson, Ingersoll, Welch, Morgan, and Abbott.

On motion the subject was passed.

Section VI being called, the secretary submitted a report, the following resolution of which was adopted, as amended by Dr. Morgan, as follows:

Resolved, That an appropriation of $200 be made to Section VI for the purpose of original investigation. The same to be expended under the direction of a committee of three appointed from the Section, viz.: the chairman, the secretary, and Dr. T. W. Brophy. The subject for investigation to be pyorrhea alveolaris, and that some competent gentleman be selected by the committee to make microscopical examinations of the tissues involved, viz.: the cementum, the pericementum, alveolus, and gums, and chemical and microscopical examinations of the local concretions and exudates, and of the saliva and urine; a careful record to be kept of the results in each and every case, and the same to be the exclusive property of the Association.

Dr. Harlan then read a paper entitled "Bacterio-Therapy." He was followed by Dr. Hooper, who described certain surgical cases.

The secretary of the Section here made a supplemental verbal report, asking that Dr. D. J. McMillen be permitted to present a case of congenital anchylosis.

It was presented and then discussed by Dr. Atkinson.

The subject was passed and Section VII was called.

A paper was read by Dr. W. Storer How, entitled "Preliminary Notice of Methods of Investigating Oral Fluids, with Reference to the Etiology of Dental Caries."

Another by Dr. A. H. Thompson on "Protoplasmic Nutrition and Molecular Metamorphosis in the Dental Tissues."

After which the Credentials Committee made a further report, which was adopted.

The Auditing Committee reported that they had examined the accounts of the Publication Committee and of the Treasurer and found them correct.

Adjourned till 8 P.M.

THIRD DAY—EVENING SESSION.

The Association was called to order at 8.30 P.M., the President in the chair.

The minutes of the morning session were read and approved.

Under the head of miscellaneous business, Dr. Ingersoll moved to change the order of business, so that the election of officers shall take place to-night instead of to-morrow.

The Chair ruled the motion out of order.

The Committee on Credentials made a further report, which was adopted.

Section VII was then called, and a paper on "Diseases of the Tongue," by Dr. H. A. Smith, was read.

This was followed by another paper by Dr. A. H. Thompson on "Pathological Heredity and Gouty Teeth."

These subjects were discussed by Drs. Ingersoll, Morgan, Brophy, Ottofy, Harlan, James Truman, Atkinson, and Thompson.

No objection being made, the report of the Executive Committee was heard.

On motion it was received.

It was moved that all of the report which refers to the controversy in the Executive Committee as to the place of meeting for this year be stricken out.

Discussed by Dr. Crouse.

The motion to strike out prevailed.

The following amendments to the Constitution were proposed by the Executive Committee in its report, and unanimous consent was asked that they might be immediately adopted.

Consent being refused, they lie over for one year.

Amend Article IV by striking out all after the second sentence.

Amend Article V, section 6, by inserting the following at the end of the first sentence: "through its secretary, whose sole duty it shall be to keep a correct record of its proceedings," and by striking out the word "they" in second sentence and substituting for it the word "it."

Also in same section, second paragraph, head sub-committees, after the words "three members of this committee shall," interpolate the words, "under the direction of its chairman;" and strike out the last sentence in same paragraph.

Same section, last paragraph, heading "chairmen may convene the committee" add the following words: "and at any other time at the request of two members of the committee."

The Committee on Credentials made a further supplemental report, which was adopted.

Adjourned to meet at 9 A.M. to-morrow.

FOURTH DAY—MORNING SESSION.

The Association met at 9.30 A.M., the President, Dr. Barrett, in the chair.

The minutes of last evening's session were read and approved.

Under the head of miscellaneous business, the Executive Committee offered the following, which was adopted:

Resolved, That in the future this Association discountenance the giving of banquets, excursions, entertainments, etc., by local professional societies or individuals, either during or at the close of our annual meetings.

Dr. Dennis offered the following, which was *not* adopted:

Resolved, That it is the sense of this Association that the time of meeting of all national scientific and professional associations should be made as uniform as possible to enable those residing in remote parts of the country to attend them with much less expense of time and money than could otherwise be done, and that a copy of this resolution be forwarded to all such societies.

Dr. Marshall offered the following:

Resolved, That this Association would recommend to the various dental colleges of the country that the interests of higher education demand that the college course of instruction be uniformly extended to nine months in each year.

It was referred to the Section on Education.

Dr. Atkinson moved that Dr. E. A. Bogue be accredited as a delegate to the British and German Dental Associations.

Laid on the table.

Dr. Brophy asked unanimous consent to amend the Constitution (Article VI, section 1) so as to consolidate Section III with Section II, and to change the numbers of Sections following to conform to this change—that is, to make the present Sections IV, V, VI, and VII to be III, IV, V, and VI.

Consent being granted, the amendment prevailed.

The following, offered by Dr. Ottofy, was adopted:

Resolved, That it shall be the duty of the chairman of the Credentials Committee to procure and keep a book wherein each delegate who wishes to be considered a permanent member of this Association shall enter his name.

Dr. Marshall asked unanimous consent to amend Article VI, section 1, of the Constitution by striking out the words "Pathology and Surgery" from Section V and placing them in a new Section to be Section VII.

Consent was granted and the amendment adopted.

The hour for the selection of the place of next meeting and the election of officers having arrived, the Committee on Nominations for the place of meeting presented the following:

Chicago, Old Point Comfort, Asheville, N. C.; Asbury Park, Salt Lake City, Chautauqua, Louisville, Ky.; Cresson Springs, San Francisco.

Asheville, N. C., was selected.

The election of officers was then proceeded with, resulting as follows:

President—W. W. Allport, Chicago.
First Vice-President—G. W. McElhaney, Columbus, Ga.
Second Vice-President—S. W. Dennis, San Francisco, Cal.
Recording Secretary—Geo. H. Cushing, Chicago.
Corresponding Secretary—A. W. Harlan, Chicago.
Treasurer—Geo. W. Keely, Oxford, Ohio.
Executive Committee—S. H. Guilford, Philadelphia; W. C. Wardlaw, Augusta, Ga.; S. G. Perry, New York.

The resignations of Dr. J. N. Crouse and of Dr. C. N. Peirce as members of the Executive Committee were here tendered.

On motion the resignations were accepted.

An election to fill the vacancies thus occasioned resulted in the choice of Dr. E. T. Darby to fill the unexpired term of Dr. Crouse and of Dr. A. W. Harlan to fill that of Dr. Peirce.

On motion of Dr. H. A. Smith:

Resolved, That the Southern Dental Association be invited to meet with this Association in joint session at Asheville, N. C., on the first Tuesday in August, 1887.

On motion of Dr. Marshall:

Resolved, That $200 be appropriated to each of the following Sections, viz., Nos. IV, V, VI, VII, the same to be expended only for original investigation.

On motion of Dr. Darby:

Resolved, That the thanks of the Association be tendered to gentlemen who have given clinics and to those who have exhibited original appliances.

On motion of Dr. Hunt the following was adopted:

Resolved, That this Association tender its vote of thanks to the hotels of Niagara Falls for their kindness in reducing their usual rates for the delegates; also, to the various railroads for the same favor; to the local committee for the efficient manner in which they have performed their various duties; to the press, and all others who in any way have contributed to the success of the meeting.

On motion of Dr. Field:

Resolved, That the thanks of this Association be extended to Dr. Barrett for the able and satisfactory manner in which he has presided over the deliberations of this body during this session, and that as a token of appreciation of these services, the gavel used on this occasion be suitably inscribed and presented to him.

The minutes were here read and approved.

The Chair appointed Drs. Taft and Abbott to escort the President-elect to the chair.

Upon being presented to the Association by the retiring President, the President-elect expressed himself as not unmindful of the honor conferred upon him, for which he begged most sincerely to thank the Association, and asked "that we may one and all in the future do what we can to add to the usefulness and respectability of our profession."

Dr. Abbott asked unanimous consent to amend Article VI, section 1, of the Constitution by taking the name of Anatomy out of its present Section and placing it in the Section newly organized, Section VII.

Consent was granted, and the amendment was adopted, so that section 1 of Article VI now reads:

ARTICLE VI.

SECTION 1. To prepare, arrange, and expedite business, this Association shall be divided into seven Sections, as follows:

I. Prosthetic Dentistry, Metallurgy, and Chemistry.
II. Dental Education, Literature, and Nomenclature.
III. Operative Dentistry.
IV. Histology and Microscopy.
V. Materia Medica and Therapeutics.
VI. Physiology and Etiology.
VII. Anatomy, Pathology, and Surgery.

The President appointed on the Publication Committee Drs. E. T. Darby and A. W. Harlan.

And on the Local Committee of Arrangements, Drs. T. T. Moore, of Columbia, S. C.; M. A. Bland, of Charlotte, N. C., and B. H. Douglass, of Asheville, N. C.

The minutes were then read and approved, and the Association adjourned to meet on the first Tuesday in August, 1887, at Asheville, North Carolina.

GEORGE H. CUSHING, *Secretary.*

ANNUAL ADDRESS.

BY W. C. BARRETT, PRESIDENT.

CUSTOM demands that I shall at this time present an address for your consideration. It is manifestly improper for me to write a disquisition upon a scientific theme, because as your presiding officer it is not my province to enter actively into your debates. I do not desire to inflict upon you platitudes and commonplaces, nor will I ransack the book of Constitution and By-Laws in search of something that will bear changes, that I may recommend tinkering to you. I am not an admirer of ironclad rules, and candidly believe that the will of a manifest majority is of more importance than all the by-laws that were ever inflicted upon societies. The most that can be said for them is that they are a necessary evil, but they too often hamper and embarrass scientific investigation and prove a refuge for mediocre men, who can talk learnedly of rules of procedure, while they are dumb as oysters when technical matters are under debate. I should pay you but a poor compliment if I supposed that you could travel perhaps thousands of miles to listen to an essay on parliamentary law.

I might, perhaps, descant largely upon the importance of the American Dental Association, but this would be less profitable than the pointing out of methods by which its efficiency could possibly be increased. I love the Association; I desire to see it stand at the head of all such organizations in the world, and to this end would be glad if it were in my power to add anything to its efficiency. Perhaps I cannot do better than to point out a few particulars in which, to my mind, it can be improved.

A national organization that is the representative head of American dentistry should be a dignified body and one that truly represents the profession. It should be made up of our best men. It should lead in thought and possess the scientific confidence of every man. It should have a standing among scientific bodies and its decisions upon professional matters should in the eyes of all men be

final. I dare say that each one of you is as anxious as I can be to have this society occupy high ground, and it only remains to inquire what steps can be taken to increase its efficiency.

The wise man, when he would consider in which way he is drifting, endeavors to determine the rate of his progress by comparison and to examine every landmark that he may the better be enabled to judge of the progress he is making. If the American Dental Association is to be the acknowledged head of dentistry in this country, it must be worthy of the position. That proud place is not to be won by mere self-assertion. It must exercise an influence for good. It must inculcate a culture that is broad and deep. The Association is supposed to be made up of the best minds of the profession. It represents the ripest thought, the broadest scholarship, the highest intelligence of dentistry. The subjects which are brought before it for consideration should be commensurate with the standing of its members. It should discuss only broad principles and fundamental laws. It cannot, without derogating from its dignity, descend to trivialities and special methods. The men who come here should be prepared to consider and intelligently discuss technical matters. Enough work should be cut out at each of our meetings to afford food for thought during the whole year. We should leave all elementary matters for elementary organizations. We should shake off as far as is possible all the shackles that hamper debate. We should be so enamored of purely scientific matters that we should take up anything else with great reluctance. As it is, we have too much machinery. There is far too much of professional politics for an organization that aims to be a leader of thought. During the past very many excellent papers have been read here, but too often they have been sandwiched in between mere compilations and exhibitions of windy rhetoric. A scientific body is no place for the display of verbal pyrotechnics or professional stump speeches. We want more of original work and less of borrowed words. A mere string of glittering generalities may serve to tickle the ears of the groundlings, but such displays do not advance our scientific status. Too often has it been the case that when a paper worthy of this body has been presented it has been but coldly received, and member after member has dropped out till only an array of empty seats has greeted the essayist at the close of his remarks. But when some one has gained the floor who has turned the whole proceedings into a mere farce, he has been loudly applauded and thus encouragement given to turn the meeting of our brightest minds

into a mere show. We are not supposed to come here to be amused or entertained, but to indulge in serious thought. To the casual visitor we should present the aspect of a body of earnest men, who are discussing weighty problems.

We are not supposed to come here to consider elementary subjects. This is not an experience meeting, and the relation of long-winded incidents of office practice, with elaborate details of the birth, parentage, and social standing of our patients, is out of place. There are many subordinate and local societies in which methods of practice and special manipulations may with propriety be considered. But in our national society we should rise to the plane of general laws and fundamental principles. Let us conduct our debates in a manner worthy of earnest scientific men.

We have had too much of business brought before the society and have too earnestly and long debated parliamentary law and questions of order. The overriding of a by-law is a small matter if it will further the scientific ends of the organization. By-laws are supposed to be intended to further the objects of the society, but when they manifestly stand in the way of compassing a desirable end, they should give way. I am not advocating the abrogation of law nor the willful infraction of wholesome regulations, but I do not think it well to fritter away valuable time over an unimportant regulation when it manifestly stands in the way of reaching the will of the members.

We must foster and promote original investigation. It has too often been the case that when a member has presented the results of his study and extended experiments, he has been listened to with marks of impatience at the dry details, and the general desire for practical matters has been too apparent. This society has not enough encouraged scientific research. I am glad that at the last meeting a new departure was inaugurated and the American Dental Association commenced to devote some of its funds to original research. No organization can have a recognized standing which does not actively engage in original research. We are not supposed to be a money-making or a money-saving body, and we cannot without loss of dignity sacrifice our scientific interests to the desire to save our money.

It would be well for us if we should more carefully consider the amenities of debate. There has at times been a lack of the decorum which should be observed, and speakers have too often engaged in personal discussion. Nor is it respectful when a member has been at

much pains to prepare and come a long distance to read a paper, if he be not listened to with attention. No greater indignity could be offered an essayist at such times than to engage in whispered or loud conversation or in moving about and manifesting impatience.

It is one of the most important rules of such assemblages as this that every one in speaking should address the chair. He is supposed to be talking only to the chair, and remarks addressed by him to other members or by any of his audience to him are entirely out of order. May I not ask your assistance in insisting that whenever a question is to be asked or an answer given it be addressed to the chairman? In this way all acrimonious personal controversies will be avoided, good order maintained, and debate greatly facilitated.

I also ask your hearty coöperation in preventing unnecessary moving about during the debates, in suppressing needless private conversation, and in banishing from our sessions everything that shall in any way interfere with the manifest objects of our meeting. In this way, and in this way only, shall we make of this a successful meeting and at the end have the satisfaction of knowing that we have materially advanced the cause we each have at heart.

And now, gentlemen, let us to our work, each determined to do something to promote the general good of all.

SECTION I.

PROSTHETIC DENTISTRY, CHEMISTRY, AND METALLURGY.

REPORT BY W. B. AMES, SECRETARY OF THE SECTION.

IN the absence of the chairman I have the satisfaction of announcing the reading of two voluntary papers, one sent by Dr. Wm. H. Trueman, entitled "Recent Improvements in Vulcanizers and Vulcanizing," and one by Dr. L. P. Haskell, entitled "Mineral Teeth—Needed Improvements."

From among the matter published during the year, we wish to mention the paper read by Dr. K. B. Davis before the Illinois State Dental Society, 1885, which is worthy of a careful perusal; and the report on Artificial Dentures, given to the Connecticut Valley Dental Association, which undoubtedly furnishes a valuable key to the question of the utility of plates of different materials.

We congratulate ourselves on the prospect of carved porcelain block, continuous-gum, and other porcelain work becoming more generally used through the perfection of the small gas furnaces.

A vast amount of attention, skill, and ingenuity is being devoted to the perfection of systems of crowning and bridge-work, as is evidenced by the various articles published within the year. The popular demand for smaller appliances to be worn in the mouth, created by the full-page advertisements of a class of men who have their own pecuniary interests more in view than the welfare of their patients, has stimulated some of our best manipulators to accomplish the desired results in a manner that is conducive to cleanliness and preservation.

Bridge and crown-work as constructed and adjusted by those who make it a specialty and do most of it, is apt to be of a lower standard than that done by those who only use the system as it seems especially adapted to the case in hand, because when the detail of an operation is intrusted to an assistant the results must almost necessarily retrograde.

The practice of permanent bridging was in serious danger of being voted into disrepute, when, as said, some of the more conscientious manipulators set about perfecting methods which promise to be of more general value. We have received from Dr. C. S. Stockton the description of a method, which I will give in his own words. In speaking of bridge-work, he says, "The principal objection to this style of work is that it becomes unclean by reason of the inability of the patient to remove it. In order to overcome this defect, my plan has been in the construction of such pieces, when practicable, as follows: adjust the caps to the roots or teeth, take an accurate impression and articulation with the caps in place. Trim the model slightly on each side of the ridge, and burnish a plate of pure gold to fit it. Stamp out gold crowns with Dr. Patrick's machine and accurately fit them in place to the pure gold base-plate and to the articulation; solder the crowns to the pure gold base-plate and to the caps, thus having a piece when in place without receptacles for food and saliva, and one that will remain free from nastiness."

We think that the description of the process is faulty, in that it dwells too little on the fitting of the caps to the supporting roots and teeth.

Dr. J. A. Swasey has shown a method of adapting a removable bridge, or, more properly, very small removable plates. By this method a continuous band is adjusted, usually to the tooth posterior to the space to be filled, and a small, narrow plate struck up to fit the ridge, which is soldered to the band, with teeth properly adjusted and articulated attached thereto by solder.

The advantage claimed for the process is the great superiority as to stability of the continuous band over the open clasp, which, if accurately fitted, need not be cemented in place to give this stability. The band should not be made to pass *beyond* the largest circumference of the tooth, thus being kept from the gum and preventing all friction and wear. It should fit as snugly as is practicable. Dr. Swasey has constructed numerous appliances of this kind, and with a greal deal of satisfaction to himself and patients. He is prepared to show a practical case illustrating the method of construction.

Dr. Geo. W. Melotte, of Ithaca, N. Y., has presented some ideas on bridging to the Section which we consider of sufficient value to receive the consideration of those interested, and suggest the selection of a time when Dr. Melotte and others with such special methods may be seen and heard. Dr. Melotte has furnished the following formulas: For impression material, potter's clay, mixed with

glycerin to form a stiff paste. For fusible metals, bismuth 16 parts, tin 10 parts, and lead 6 parts.

Dr. Dorrance, of Ann Arbor, will present a continuation of his report on effects of vegetable plates, and also his formula for alloy, which was given in 1882 before this Association, but was not published in the Transactions. We hope it will appear this year.

SECTION I.—Continued.

Recent Improvements in Vulcanizers and Vulcanizing.

PAPER BY WILLIAM H. TRUEMAN, OF THE SECTION.

ALTHOUGH, since their first introduction, there have been many changes in the size, form, and construction of dental vulcanizers, so far as we now remember, there were none that to any great extent modified or changed the process until Dr. Campbell introduced the New Mode Heater.

Dr. Campbell's long experience in the manufacture of vulcanite suggested to him that a better result would be obtained if the process of manufacturing it commercially was more closely followed in the dental laboratory. He claimed that the prepared rubber should be kept as nearly as possible absolutely dry during the process of packing and vulcanizing; and that to immerse the flask in water or to place it in the same vessel in which the steam was generated, as must necessarily be done in using any of the dental vulcanizers then in general use, was radically wrong, and invariably produced an inferior article.

About the time he invented and introduced his New Mode Heater, celluloid threatened to become a successful rival of vulcanite; and no doubt his efforts to produce a machine that could be used equally well for constructing dental plates from either material, modified to some extent the construction of his apparatus. It consists essentially of two distinct chambers, one inclosed within the other. The outer chamber alone is supplied with water, to this alone the heat is applied, and in it the steam is generated. The inner chamber, or vulcanizing oven, is so constructed that steam can be admitted or allowed to escape from it at will, and the work introduced or removed without changing to any great extent the temperature of the outer chamber or steam-generator by which it is almost entirely surrounded. As a machine for packing celluloid,

it contains several novel, ingenious, and useful features, and we think it has proved more effective for this purpose than as a vulcanizer. We presume you are all sufficiently familiar with its appearance and construction to readily follow, without a detailed description, our brief reference to it. We desire to call attention in this connection to its use as a vulcanizer, and especially to several novel features which, probably having been suggested by it, have been more fully carried out in a machine recently introduced, known as the "Seabury Dry Steam Vulcanizer."

The New Mode Heater radically changed the process of vulcanizing as usually carried out in the dental laboratory. In practice the heat was applied, and the required temperature obtained in the steam-generating chamber in advance, the valve controlling the connection between it and the vulcanizing oven being closed. If desired, the flask and its contents may be placed in the oven and thus heated or dried preparatory to packing in it the prepared rubber. After the rubber has been placed in the mould, the flask is returned to the oven and allowed to remain until it is sufficiently heated to render the rubber plastic. It is immaterial whether the oven at this time be tightly closed or not. When the rubber has been rendered plastic, the mechanism designed for packing celluloid is used to close the flask, this operation being performed while the flask is still in the oven, and without changing its position. This is an admirable feature; if the pressure applied was modified by means of a spring, so as to be more elastic, as is done in some forms of presses for packing rubber, it would leave but little to be desired, so far as packing rubber is concerned. As it is, we consider it the most desirable, safe, and convenient method of packing rubber at present available. After the flask is closed, it may be allowed to remain in place, or the ordinary bolts used with the flask may be adjusted. It is then ready for the vulcanizing process. The vulcanizing oven is closed steam-tight, the valve controlling the connection between the steam-generator and the oven opened, and steam, at about the vulcanizing temperature, allowed to enter the oven. This is really its novel feature, and wherein it differs radically, so far as we now remember, from all dental vulcanizers in use at the time it was introduced. Instead of placing the flask and its contents in a cold, or nearly cold vulcanizer, and by the application of heat gradually increasing the temperature of the vulcanizer and its contents until the thermometer indicates the required degree, it is placed in a previously heated oven, and immediately surrounded by steam of

very nearly the vulcanizing temperature. Instead of slowly heating the prepared rubber so that the gases given off during the process may not be evolved too rapidly and make the product porous, it is immediately surrounded by an atmosphere of steam under sufficient pressure to prevent their too rapid escape; by inverse method the same result is accomplished in either case, with this difference, however, that while it is always possible to command the required steam pressure, it is not always practicable, by the older method, to so control the heat as to avoid a slight porousness if the plate is unusually thick.

We desire to call particular attention to this, and to the striking similarity of the novel features of the New Mode Heater and the Seabury machine; not for the purpose of reflecting upon the originality of the latter, that has carried out the suggestions of the New Mode Heater so much more completely than was practically possible with it, and by means so much more effective, as to constitute it a really new and original machine.

Excepting the researches of the late Prof. Wildman, we believe the process of vulcanizing, although in such constant use in the dental laboratory, has received but little attention. We seem to have accepted a certain method and process, and have troubled ourselves but little as to whether the process is the best or most convenient or whether the product is the best attainable with the material and means at our disposal. The suggestions of the New Mode Heater seem to have attracted but little attention, owing partly, perhaps, to the fact, that having been constructed for a dual purpose, involving processes dissimilar in many respects, and on that account somewhat complicated, expensive, and in comparison with the extremely simple machines in general use requiring considerable manipulation, its use has been quite limited. We think, also, that the claims set forth in the published advertisements, unintentionally, no doubt, giving more prominence to the results than to the novel and distinctive means by which they are obtained, lead even a careful reader to suppose that any better result obtained by it is due to the dryness of the atmosphere of steam filling the vulcanizing oven, while in reality, it is undoubtedly due to the steam pressure accomplishing far more effectively the result sought to be attained in the older method by the gradual application of heat.

Our six months' use of the latest form of the Seabury Dry Steam Vulcanizer has been so satisfactory and suggestive, and has demonstrated so fully its superiority over the older machines, that, espec-

ially as there are some points we have noticed in its practical use that so far as we know have not been explained, we have thought we could not more usefully comply with the request to contribute to the report of this Section, than by calling your attention to it; hoping that it may lead to a re-examination of this interesting process, with a view of obtaining for dental purposes a more reliable and more desirable product.

The machine to which we especially refer is the cheaper form, consisting of two similar boilers or vessels, placed side by side and inclosed in a suitable jacket or stand. The illustrated advertisements which have appeared in the various dental journals during the last six or eight months have no doubt made you familiar with its appearance and general construction. Like the New Mode Heater, it consists of a vulcanizing chamber and a steam chamber connected by a small passage, controlled by a suitable valve. Unlike it, they are separate and distinct, and are separately heated by a gas jet or other source of heat applied under each, and lighted at the same time; the intention being, that when the temperature of the steam-generator has reached the desired degree as indicated by a steam-pressure gauge to it attached, the vulcanizing oven will be sufficiently heated, so that when it is made steam-tight with the case to be vulcanized inclosed, the steam allowed to enter by opening the passage between it and the steam-generator will not be condensed, but rather, if possible, rarefied. You will see at once how similar this is to the New Mode process. With the New Mode apparatus the case is supposed to have been packed in the vulcanizing oven, and as this oven and its contents are surrounded by the steam-generator, it is reasonable to presume that they will be heated to a nearly equal degree, and that when the oven is closed and steam admitted, there will be no condensation. Both claim to use dry steam, and to surround, before vulcanization begins, the case to be vulcanized with an atmosphere of steam under sufficient pressure to retard or prevent the escape of gases from the prepared rubber during the process; and both claim that this change in the process produces a stronger and more solid plate.

The pressure of the escaping gases is very great. In a recent experiment, a large mass of black rubber was placed in a flask, and and slowly heated in a Whitney vulcanizer, over one hour being occupied in raising the heat to three hundred and twenty degrees. The pressure of the gases generated in the prepared rubber during the process so far exceeded that of the surrounding atmosphere

of steam in the interior of the vulcanizer that a large portion of plaster was forced out of the flask, and both covers of a new and strong brass flask were curved outward fully one quarter of an inch. At the same time, a similar mass of the same kind of rubber was placed in a flask precisely the same, and vulcanized in the Seabury machine. In this case, however, the vulcanizing pressure was attained in less than two minutes after the cover of the oven was closed, and yet the product, while porous in the interior, was less so than that vulcanized in the Whitney machine, and the flask came out uninjured. Other portions of rubber of less mass, not inclosed in a flask, were solid and compact, while similar pieces placed in the Whitney machine were completely ruined. This shows conclusively the advantage of the more recent process, in which the flask and its contents are at once surrounded by an atmosphere of steam under pressure.

In the Seabury machine, the flask and its contents may be conveniently heated for packing in the vulcanizing oven, the cover being laid in place but not screwed down during the process. The advantage of packing by dry heat, apart from its cleanliness, is very great. The separate pieces of rubber unite more readily and completely, there is less risk of particles of plaster being carried to and deposited in the more depressed portions of the mould, as so frequently occurs when the flask is heated in water, and there is less risk of the rubber being soiled with dirt, wax, etc. There is also far less risk of injury to the model or fracture of the mould. The dry heat hardens the plaster, while either water or steam, unless the plaster has had a number of hours to become thoroughly hard, softens it to so great a degree, that, under the pressure necessary to thoroughly pack the rubber, it is liable to give way, allowing the joints to open, or the teeth to be forced from position, thus lengthening the articulation, etc.

The facility both these machines offer for packing with a perfectly safe dry heat, adds very much to their usefulness. There is need, however, of a simple device for automatically closing the flask as the rubber becomes plastic. There are on the market several devices for this purpose,but few that can be used without removing the flask from the oven, and all of these that we have examined are far too limited in their range for practical usefulness. There is one point in packing rubber that we think is not generally appreciated, and that is, the possibility of its becoming partially vulcanized during the packing by too great a heat, or by continuing the heat too long.

The heat of boiling water is hardly sufficient to render the rubber thoroughly plastic, and at a greater heat than this, the rubber soon becomes so changed that its plasticity is materially reduced. Indeed, a few minutes' neglect may allow this change to advance so far that the rubber will not pack at all. An automatic device for closing the flask while it is still in the oven, but before the oven is closed for vulcanizing, would avoid this, and permit the packing to be done while the rubber is in the best possible condition for the purpose.

The addition to a vulcanizer of a device to regulate the heat increases far more than is generally appreciated the usefulness and safety of the machine. A few degrees beyond the excessively high heat usually employed for vulcanizing rapidly destroys the texture of the product, and this beyond remedy. If a temperature of 330° or 340° is reached for a few moments, no after-care can restore to the product the strength and toughness it has lost. In the small machines generally used, this frequently happens, in spite of the best practical care, especially if the thermometer alone is relied upon; for under certain conditions, without being itself inaccurate, it may register quite as much as 10° to 20° below the actual heat of the flask and its contents. Of the several regulators that have been introduced all so far as we now remember require the use of gas for generating heat. Our experience has been confined to the Coolidge apparatus. This is operated by the steam-pressure, very much in the same way as is a steam-gauge. While we consider it invaluable, and would not dispense with it unless in favor of a better, it is not sufficiently sensitive and reliable. Two we have had under observation, in the hands of different operators, behave precisely alike, and have an extreme variation of from ten to fifteen pounds; that is, if set to keep the pressure at one hundred and ten pounds, changes of gas pressure may cause the steam-gauge to register one hundred and five, or one hundred and fifteen pounds. As long as the gas-pressure remains nearly the same as when the regulator was set, it continues to act, and maintains the pressure at the same point, but cannot be relied upon to do so under other conditions. In both cases the regulator has been tested in connection with a steam-gauge, so that this is not due to inaccuracies of the thermometer; and the tests, extending over a period of six months, have been frequently repeated, both experimentally and practically. It may be depended upon, however, to keep the machine within a safe range.

We question if, in ordinary hands, either the steam-gauge or the heat-regulator has proved of much practical use on the small vul-

canizers; the constant, and at times rough handling they receive will very soon destroy either apparatus. They must both be "fixtures." This requires frequent coupling and uncoupling that is not only troublesome, but the risk of leakage it introduces is a serious matter with a machine reduced in size to the smallest possible dimensions.

The construction of the two machines referred to permits the use of apparatus to register the pressure and to regulate the gas supply under favorable conditions. If provided with a really reliable heat-regulator, they may render practical a desirable change in the method of vulcanizing; that is, to conduct the process at a very reduced temperature, and for a longer time. This is our reason for calling your attention them. It is very seldom that a piece of work is so hurried, but that four or five hours, or even a longer time can be allowed for vulcanizing, provided that the vulcanizing machine is so constructed that, after the flask is placed in it, it can be depended upon to take care of itself until the process is completed. With the ordinary machines this is not possible. They require constant personal attention; the risk of a few moments' unavoidable inattention permitting the temperature to increase to a degree that destroys all the advantages promised by these long hours of constant watchfulness is too serious to incur. With a reliable regulator, and a simple clock device to shut off the gas at the same time, the process of vulcanizing becomes almost automatic, and the time may be extended as much as desired. Dr. Wildman, many years ago, called attention to the superior product obtained by reducing the temperature and extending the time in vulcanizing rubber for dental purposes. He stated that not only is the strength increased and the appearance improved, but the decreased risk of decomposing the coloring-matter is an advantage well worth considering.

The instructions accompanying the Seabury Dry Steam Vulcanizer direct that the heat be applied to the steam-generator and the vulcanizing oven at the same time; the flask, however, is not placed in the oven until the steam-gauge indicates a pressure of one hundred and twenty pounds; when this pressure is attained, the flask is placed in the oven, the cover made steam-tight, and the valve connecting it with the steam-generator quickly and widely opened. This reduces the pressure. It is again allowed to reach one hundred and twenty pounds and kept at this point one hour. The result is, perhaps, a little harder than is usually deemed desirable.

It was, at first, a matter of surprise that in this machine a tem-

perature of 345° maintained for one hour should produce a serviceable plate; while the same rubber, vulcanized the same time, and at the same heat, in a Whitney machine, would be completely ruined. It required, however, but a moment's thought to appreciate the dissimilar conditions. In the Whitney machine, and others of its class, the rubber is subjected to the full heat the entire time; in the dry steam machines, considerable time will elapse before the suddenly applied heat penetrates the contents of the flask, dry steam being a far less ready conductor of heat than water, so that when the instructions of the Seabury machine are followed, we are really vulcanizing at an excessively high heat for a short time.

If brass flasks are used with the dry steam machines, the process of vulcanizing becomes remarkably cleanly. The plaster of the mould being dry is far more pleasant to handle, and there is no deposit formed upon the flask to soil the hands. Repair cases come from the flask as clean and smooth as they were before revulcanizing; the roughness, so frequently seen when the old process is used, and evidently caused by an expansion of the original rubber, we have not found in a single instance.

Discarding the claims set forth in the published advertisements, we respectfully suggest that the new method of immediately surrounding the flask and its contents with steam under pressure as great as will be attained during the process is well worth your consideration.

We also suggest the possibility of materially improving the product and rendering the process safer by employing a much reduced temperature, controlled by automatic devices, hoping that the inventive skill of the Association will soon supply the means to make this practical.

SECTION I.—Continued.

Mineral Teeth—Needed Improvements.

PAPER BY L. P. HASKELL, OF THE SECTION.

ONE of the most serious annoyances in the department of Prosthetic Dentistry is the difficulty of securing teeth to match the natural organs in color, as well as in shape. What I shall say will be confined to single plate and gum teeth.

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Having been familiar with the manufacture of mineral teeth for forty-one years, the first twelve of which I spent in carving block teeth for my own practice and also for the profession, I am able to speak advisedly.

When I commenced the study of dentistry, Alcock and Stockton, both in Philadelphia, were the only manufacturers of mineral teeth, which, of course, were used exclusively on metal plates. Soon after, S. S. White, an employé in his uncle's factory (Samuel W. Stockton's) started a new establishment, under the firm name of Jones, White & McCurdy. Mr. White took charge of the manufacturing, and there was at once a great improvement in moulds and color over anything previously made. Some of the most perfect shades were produced, the teeth being clear and very natural in appearance. In the course of time the material became more *opaque*, and as a necessary result, the colors were not as satisfactory. Why was this? Because, in the attempt to secure a *stronger* material more silex and clay, or less feldspar was used, and so there was less translucency, and necessarily less of natural appearance.

The next manufacturers in the field were, I think, the firm of Orum & Armstrong, with H. D. Justi, first as manager, later sole proprietor. The results of his personal efforts as to coloring and shape were eminently satisfactory, but as in the case of S. S. White's teeth, they gradually became more opaque, and lost, in a measure, the life-like coloring, so that now in attempting to find a set of plain teeth, after ransacking two or three dental stocks, I

am often compelled to make use of what does not suit me at all, and in matching partial cases I am sadly perplexed.

Every dealer, so far as I have seen, is carrying a larger stock of teeth than there is any necessity for. I do not know of a stock out of which a large proportion ought not to be broken up, and the pins put into a fresh stock; for in selecting teeth we are compelled to go through this culled-out stock, the remains largely, perhaps, of a quarter century or more of business.

I do not know of a stock of teeth which might not be reduced one-third, if the remainder were made up of more generally medium sizes and colors which are more often required in matching the natural organs. Miscellaneous bicuspids and molars (and in fact these teeth in full sets) should never be white, but darker in shades than the anterior teeth.

Fifteen years ago, or more, from a small stock of *gum-plate* teeth contained in three drawers, I could select, in fifteen minutes, a perfect match for partial sets, and yet to-day, from a much larger stock, in the same establishment, I cannot begin to find what I need, nor can I elsewhere.

There are certain colors in teeth which are needed far more often than others, which are the most difficult to secure. For instance, in the yellow, which all teeth possess to a greater or less extent, for a long time was the brownish yellow, only sometimes needed, while the straw or lemon colors, in their various shades, so common in the natural teeth, were not to be found. This has been to a great extent remedied, and the failure now is mainly in the blue and gray shades, and in the blending of these with the yellow, and yet these combinations were successfully produced formerly by our leading manufacturers.

I recognize the fact that one of the most important of the materials used in teeth, feldspar, varies in quality, making the porcelain at times more or less opaque or milky, but I am of the opinion that the main difficulty lies in the attempt to secure a strength which is uncalled for.

For *bony* appearance of texture, life-like coloring, in fact nearness to nature, Ash's teeth are unexcelled, and yet they use the American feldspar. But in order to secure these results, the formula for the material is such that they are fused at so much lower a temperature than the American teeth that they cannot be used for continuous-gum work. While these are not as strong as the American teeth, they are strong enough, dense and hard to grind, and stand the

"blow-pipe test" admirably. Then again, in the low fusing materials, coloring-matters can be used which cannot in the higher fusing, on account of their bleaching, as for instance, cobalt.

I see no reason why our own manufacturers may not use a lower fusing material, even in continuous-gum teeth, and so attain more satisfactory results in coloring.

The next point for consideration is the need of *alteration* in shapes of more or less of the teeth, and also to some extent the arrangement of the pins. There is too great a tendency to multiply moulds, not because the manufacturers desire it, but because they think the profession require it, whereas such demand is only upon the part of a few cranks, with some crochety notions to carry out. I think the moulds could safely be reduced in number one-fifth. A large number of the very small moulds ought to be left out; they are of sizes that no dentist with any regard for his reputation ever makes use of. There are some uncouth sizes, "*horse teeth*," that are utterly unfit for any human mouth. If a patient's natural teeth were as large, it would be a mercy to remove and replace them with something more presentable.

In continuous-gum teeth it is an easy matter to alter shapes (teeth of course which are not porous and whose enamel fuses slightly at the baking of the continuous-gum body), narrowing, flattening, lengthening at the neck by adding on the continuous-gum body, which I am constantly doing.

Gum-plate teeth, now that the day has passed for mounting full sets, backed and soldered, are only needed for partial sets. This being the case, the gums should be short,—that is, extending but a short distance below the neck of the tooth,—so as to match the receded natural gums. This is especially true of bicuspids and molars.

Too large a proportion of plate teeth, both gum and plain, have "cross" pins. These should be used only when absolutely necessary, as the perpendicular position of pins is stronger.

In rubber teeth there are many moulds where the pins, even in long teeth, are placed near the cutting-edge of the tooth, making a short shoulder and a thickening at the edge that is unnatural and interferes with speech. There is no necessity for such a condition of things.

On most of the rubber teeth there is a flange around the neck, which there is no necessity for. A case cannot be waxed up so as to shape the rubber gum properly with this flange upon the tooth. I am always compelled to grind it off.

In bicuspids and molars the grinding surfaces in a majority of

moulds are not broad enough,—often ridiculously thin as well as narrow. It were better, for the usefulness of these teeth, if there were less difference in length of the outer and inner cusps, especially avoiding the overhanging outer cusps, as they interfere with the lateral motion of the jaws by displacing the plate.

There is not sufficient attention paid to the relative size of the six anterior and the posterior teeth, length and width often being out of all proportion.

Teeth are very often overbaked, the effect of which is to destroy the outlines, giving a glassy look and injuring the color.

One of the merits of Ash's teeth is their density. Any portion of the enamel or body may be ground and not leave a dirty surface, or one that soon becomes so. Teeth that will admit of this do not require so large a variety of moulds.

I know we are often met with the assertion that teeth as they are furnished are sold as fast as they are made, but that is no reason why as perfect a thing as possible should not be made, thereby educating those who are careless in these matters to a higher standard. Let our tooth manufacturers become educators in some measure.

What we want is not cheaper but better teeth, and if necessary to accomplish this let manufacturers charge more for them.

I have made no invidious distinctions between manufacturers, for they all have their merits, and most assuredly all have their demerits; but I have brought the subject before the Association as one of great importance, and I trust it will receive the attention it so much demands. It is a singular fact that while the sale of American teeth is very great abroad, in England as elsewhere, there is a rapidly increasing demand for English teeth here. This fact alone ought to stimulate our own manufacturers to improvement.

SECTION I.—Continued.

Notes on Vegetable Bases for Artificial Dentures and on a Solder Alloy.

By W. H. DORRANCE, of the Section.

AT the meeting of 1882, a short report was made on the observation of two hundred and eleven cases of patients wearing artificial dentures on vegetable bases (rubber and celluloid). A record has since been continued up to five hundred cases, and it is of interest to note the following slight changes in the percentages:

Leaving out of the question the probable mechanical injury from ill fitting, the number of cases in which the injury was serious is increased to fifty-five per cent. The number of cases apparently uninjured is increased to nine per cent. It is also interesting that in those cases where treatment and the insertion of dentures upon metallic bases were resorted to, improvement in the condition of the mouth was not only marked but radical.

In making these observations note was also made of the general condition of the patient, the cleanliness of the mouth and plate, as well as the length of time the denture was worn.

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The substance of the following note was presented verbally at a previous meeting, but failing to appear in the proceedings for that year, has been the subject of many inquiries. This note is therefore made for the convenience of interested members of the Association.

It should be borne in mind that it is a characteristic of the metals which may be used to lower the fusing point of a solder without lowering the carat (zinc being a type) to render gold brittle.

The process of formulating and compounding an alloy with which to form gold and silver solders, developed what seems to be a fact, that pure zinc,—*i.e.*, free from arsenic, antimony, cadmium, etc., would not render gold brittle.

Take of chemically pure metals, silver, one part; zinc, two parts; copper three parts.

The copper is melted in a clean, borax-lined crucible, the silver added, and then the zinc in small portions, with constant agitation by stirring with a clay rod.

When the denser fumes of the burning zinc pass off, pour from a height into water, or pour into an ingot mould. The resulting "solder alloy" may be used in the place of the metals usually employed in connection with gold and silver for gold and silver solders, with the following results: The solder will follow and retain the color of the plate used, and will be as tough and free from brittleness.

The usual method of employing this alloy is to take from four down to two parts of either gold or silver (as gold or silver solder is desired) to one of the alloy, melting together under borax with agitation, rolling to the desired thickness, and marking on one end the carat of the gold used (if gold) and also the proportion of gold, as for instance $\frac{20}{3}$ ($\frac{\text{20 carat gold}}{\text{3 parts gold}}$). The solder formed by the use of this alloy is easily made, easy flowing, and as strong as the plate from which it was made.

DISCUSSION.

DR. PEIRCE: If I understood the last gentleman when naming the percentage of injuries that occurred from rubber plates, he did not state the nature of those injuries nor whether they originated from the poisonous influence of the plate or from some other cause. I suppose he has a record as to the nature and causes of the injuries he has reported.

DR. DORRANCE: My observations lead me to the conclusion that this condition of the mucous membrane is produced by the retention of heat, the rubber and celluloid being non-conductors. The worst case that was observed was in a lady's mouth, who was very careful of her plate, which had been worn but fourteen months, and the improvement was very marked indeed, after substituting a metal base. There may be a question in the minds of members of the Association as to the effect of the coloring-matter in the bases. I think that there are very few plates made upon so poor a rubber as to permit this consideration to enter into the discussion.

DR. PEIRCE: I want to get the facts in the case. I would like to know whether the gentleman found any variations in the conditions where black or where red rubber was used,—something that would

indicate whether the effect came from the toxic influence of the coloring-matter or from some other cause.

DR. DORRANCE: I have noticed no material difference. The first case that set me to thinking about this matter occurred quite a number of years ago. The patient was a physician wearing a red rubber plate, and I suggested to him that doubtless the coloring-matter was the cause of the injury, and substituted for the red a black rubber plate. He said a few days afterward that there was a marked improvement, but subsequently, upon examining the case myself, I could see no improvement at all. However, upon substituting a metallic plate, the improvement at once began, and gradually progressed until recovery was complete. That was before I began to take notes. Subsequent cases convinced me that the retention of the natural heat of the mouth was the chief cause of the trouble, though the fact that the rubber plate cannot be kept so clean as a metal substitute probably somewhat aggravates the difficulty.

DR. SPAULDING: I would like to ask the gentleman if he did not notice a marked difference in mouths where the plates had been kept clean as against those where the plates had *not* been kept clean, the plates being of the same material?

DR. DORRANCE: Under one silver plate that was very filthy the mouth seemed as bad as under a rubber plate. In answer to Dr. Spaulding, notice was taken of cleanliness in the observations, and though I have no doubt that an unclean plate augments the trouble, I must express my conviction that the prime source of the diseased condition observed is non-conduction, for I certainly noted many cases of clean-looking gums under unclean plates.

DR. FRIEDRICHS: If I understood the last speaker, he stated that fifty-five per cent. of all rubber plates produce these injuries. At the least calculation there must be ten million people in the United States who have worn plates of vulcanized rubber. If his conclusions are correct, would not this evil have come more prominently before us? Would this material have been tolerated so long as it has under such circumstances? To show the folly of jumping at conclusions, let me relate an incident. My preceptor in St. Louis put in a set of teeth on gold plate for a gentleman who had hemorrhage of the lungs two hours afterward. Did the gold plate produce the hemorrhage? I want to call the attention of the society to this fact: if rubber plates produce the effects that have been claimed, it would be patent to everyone in the profession, and rubber would long ago have been thrown aside.

DR. OTTOFY: Prof. Black, who, I am sorry to say, is not with us, has investigated the subject recently very thoroughly, and the results of his investigation, if not conclusive, are at any rate very interesting. It is his opinion, I believe, that it makes no difference of what material the plate is made, provided it is kept clean, and he has found that the micrococci grow under plates of all kinds if they are not kept clean. He has separated and bred them in culture tubes and has named that class streptococcus magnus. I think when the subject is thoroughly investigated, this theory may fully explain this question. I do not believe the material of which the plate is made makes any difference. I agree with Dr. Black that disease depends entirely upon the cleanliness of the patient.

DR. CUSHING: I think the last speaker somewhat misrepresents Dr. Black's position. As I remember his remarks, he did not state that the diseased conditions were as bad under one plate as another, but that the micrococci were found under all plates alike where they were unclean. I think I am right in stating his position.

DR. OTTOFY: That is the idea I meant to express.

DR. CUSHING: He did also state that the rubber and celluloid plates form a better hiding place for germs than metallic plates, but where both kinds were not kept perfectly clean, the micrococci were found under one plate the same as the other.

DR. MORGAN: I remember a year ago it was insisted that this Section should have an opportunity to present its work early in the session, for the reason that it had usually been postponed until toward the close, and then it was passed over hurriedly without any discussion. If there has been a single thing said to-night that is not a rehash of what we have had over and over for years, I don't know it, except the statistics given by Dr. Dorrance. We have the same old statement that the mouth eliminates natural heat, and that the retention of that heat is destructive to the tissues (all of which is mere inference), and not a single fact offered to prove it. I expected when this Section had a whole year to work in, when they insisted so strenuously for time, that we should have some principles elucidated that would throw some light on this subject. I am amazed that so little has been advanced that is new.

DR. JAMES TRUMAN: It seems to me that the subject of bridge-work should be taken into consideration, not only in a mechanical sense, but in its scientific aspects. Principles should be talked about as well as the mere practical details. We are in a transition state, in my judgment, passing from a condition in which mechanical den-

tistry was almost a lost art to a better state of things. That this is true must be very evident to every individual who has carefully observed the beautiful specimens of bridge-work exhibited in the clinic rooms of this Association. They are, to me, works of art, and are worthy of our highest appreciation and most careful examination. In connection with this there arises a question: Are we not going too far and too rapidly in the introduction of this character of work? Is the effect of placing a band upon a tooth clearly understood? It would seem not, if I may judge from some operations I recently witnessed, in which the artificial crown was forced so far and so roughly upon the pericementum that it appeared to me destructive inflammation must inevitably result. Are we not violating physiological laws whenever we undertake to press too severely upon that delicate membrane, the pericementum, and may not such treatment result in pathological conditions impossible to overcome? These are important questions, and it is high time, in my opinion, that the matter should be considered closely and intelligently.

If it be impossible to place a single rubber band or an ordinary string around the pericementum without causing the destruction of that membrane, how will it bear a band continuously pressing upon it? Many are placing these crowns daily for patients, and it should be understood that there is an ever-present danger of producing a permanent injury to the root. It may be argued with some force that these are placed on roots ordinarily worthless. This is true in many instances, but by no means is it true in all cases. The law governing irritation of the pericementum is applicable where whole teeth are involved. Are we cautious enough in the use of clamps? What is the effect of the rubber dam forced on to the pericementum and kept there for a lengthened period? In the light of experience the answer should readily be given. The result may be the same as that already stated. It is an ever-present risk, and if the teeth be not eventually loosened, pericementitis of a modified character may result. I present these remarks by way of caution. The subject should be discussed, and the principles governing it be thoroughly considered by this Association, for that I understand to be the object of our coming together.

DR. ATKINSON: I am so glad to hear a man speak of principles that underlie facts, which should govern us in all our actions, that I wish to take a few minutes to say how that impresses me. It is well for us when we name finalities to know that they are finalities and when we make statements to have them well founded. The

statement made by the gentleman who advocated principles was that the pericementum is an irritable and tender element or tissue. If there is a tissue of the body that will bear abuse it is the white connective-tissue element that makes up all these membranes. It will bear more abuse than any other tissue, which is evidently an important matter of knowledge. Where is the difficulty? It is a want of knowledge of how much loss there has been at the end of the root, whether it is fit to be crowned or not; so that if we are talking of principles we must hold to them and hew to the line. I have seen many cases where crowns had been put on absorbed roots in which there was certainly not more than a quarter of the length of the root remaining, and I think you will find in almost every man's cabinet more or less of such cases. That does not militate against the practice of doing work as it ought to be done. Let us get out of the slough of despond in which we are, and let us have our ideas clear enough so that we shall walk with some degree of confidence and certainty in the knowledge that we possess; so that when we make a diagnosis it shall not be an ignosis,—a want of knowledge of the principles governing the case,—and then pronounce finalities as to what can and what cannot be done. We do not know negatives.

So far as bridge-work is concerned, in the hands of an intelligent man it is the *ne plus ultra* of anything in the shape of supplying artificial dentures to the mouth.

DR. HORTON: In his remarks last evening Dr. Morgan took the members of this Section severely to task for not bringing out something practical upon this subject of the deleterious influence of rubber plates upon the hard and soft tissues of the mouth, averring that they had made *no* advancement towards a solution of the problem since their last report one year ago; in fact, had thrown no light upon the subject whatever. But he also leaves us in the dark as to the cause or what he *thinks* the cause may be.

While he was speaking, it occurred to me to suggest a theory by which to account for certain conditions found in the mouths of a large majority of persons wearing rubber plates.

It has been maintained by most writers and speakers that the whole trouble came from the toxic influence of the material used in coloring the rubber. Hence, you hear of dentists recommending as an antidote or preventive for such cases the use of celluloid, black or pink rubber instead of red, which is colored with cinnabar, and therefore contains poison.

I am willing to admit that there are persons whose systems are

in such a condition, particularly those having at some time been salivated, that they may be susceptible to the presence of any toxic material of which mercury forms the base, and suffer therefrom. But I think this does not occur in one case in ten thousand. Yet it has been shown by observation that a large majority of those wearing rubber plates suffer from some cause, whether the rubber be black, pink, or red, and even those wearing celluloid, all in about the same proportion. From this it would seem that we must look elsewhere than to the toxic influence of the material used for coloring the rubber, as black rubber is colored with carbon, which contains no toxic material, and the same may be said of celluloid. It was the opinion of the late Dr. Buckingham that the conditions complained of did not arise from this cause.

What, then, is the cause or causes? I think it comes in part from the nature of the rubber itself. But that is not all. Without going into a consideration of the entire subject of digestion and nutrition, or the differentiation of the material after being taken into the stomach, from which pabulum is made, I will take the chyle after it is separated from the mass. This is the prepared carbon, the consumption or decomposition of which creates animal heat. This heat is produced by the carbon coming in contact with the oxygen from the atmosphere under pressure in the capillaries, and is increased by more pressure or friction, or both.

It is a law of physiology that pressure produces absorption. This we all have proved practically to be true, who have for any cause had occasion to move natural teeth. The rubber plate being placed upon the mucous membrane of the mouth, and the air exhausted or excluded, together with the pressure and friction of the antagonizing teeth in the process of mastication, great force is exerted all over the surface of contact. This is so great as to materially interfere with the circulation, and to produce super-heat. And here I take issue with the report of the Section, which says the "warmth of the mouth is normal," or words to that effect. The heat is *super-heat*, and as the rubber is not a conductor of heat or electricity, this super-heat cannot escape, but is retained and accumulates to a certain degree while the plate is continuously worn, and until it is removed and cleaned and the mouth given a chance to cool. The resultant inflammation is enough to produce absorption of the alveolar processes, and if continued long enough of the hard bones also. Dr. Kingsley says this will not occur if the rubber in contact with the mucous membrane is finished as perfectly as we finish metallic

plates. I do not agree with him that it is so as a rule. It depends very much upon the diathesis of the person wearing the plates. I have seen the same effect from wearing rubber when the case was perfectly finished on both surfaces, but not to so great an extent as in those unfinished or uncleanly.

DR. JOHN ALLEN: I rise to ask whether there is mercury in the rubber compound, and if so, whether the soreness complained of is not more attributable to its poisonous effects than to anything else. I find many cases of extremely sore mouths arising from the wearing of rubber plates. I have quite a large number of such plates that were discarded because they caused soreness of the mucous membrane and which I have replaced with continuous-gum work, and the mouths got well. Dr. Smith, of Boston, was wearing a set of rubber, and he had continual salivation. He came to me and I put him in a set of continuous-gum, and he wrote me afterward that the trouble had entirely subsided.

A lady in Elmira wrote to me that as quick as she could get her mouth well enough she wanted to come and get a set of my teeth, but she had to wear her rubber set of teeth all the time, being at the head of a female seminary. The consequence was that the injury to her mouth and throat was so great that she lost her speech, her school was broken up, and she was lying upon her death-bed the last letter she wrote to me. Her death was occasioned entirely by wearing rubber plates, after having been salivated some years before during a severe illness, which seemed to predispose the system to mercurial action.

DR. KINGSLEY: I do not like to criticise a gentleman old enough to be my father, but really I do not think it is exactly fair to bring the principal of the female seminary into such undue prominence. The poor woman is dead and she will not be disturbed by it, but she may have some relatives who would not care to have the facts in her case brought to the notice of the public, and have her so perfectly identified that there can be no question as to who she is. Perhaps there are a few who did not know that she was wearing this rubber plate or any other plate of artificial teeth. My criticism is that in a body like this that claims to be a scientific society we can discuss principles without bringing in the names of individuals or bringing them so prominently before us that they can be easily identified and made the subject of comment. Our good old friend, I am sure, will forgive me, and I am sure he will not do it again.

I have a word to say in regard to rubber plates. There is such a

thing as making use of rubber vulcanite as a base for artificial teeth that has no mercury and no combination of mercury in any form in it. Vulcanite is pure rubber and sulphur, and I have seen many cases of sore mouths where even pure rubber was used and no mercury in its composition. I believe that rubber and sulphur, the combination which makes vulcanite, is in itself absolutely harmless in the mouth as a base for artificial teeth, but I have been vexed ever since vulcanite was introduced at seeing the wretched and miserable specimens of artificial dentures made on rubber plates as they have come from the hands of—somebody else! There is not one piece in a hundred that is decently finished on the surface that comes in contact with the gum. In nearly every one that I ever saw that surface is left just as it came from the plaster when it was vulcanized, and the rubber has been by the pressure and the process of vulcanizing forced into the minute pores and irregular surfaces of the plaster, and it comes out in exactly the condition to accumulate and retain all the filth and nastiness which can be imagined. It is almost impossible to keep such a plate as that clean. Patients may have all the fancy brushes which we see advertised for cleaning such things, but to keep them clean is simply impossible. Talk of micrococci and all the rest of the bugs, there is plenty of material for them to feed on with such a plate as that. I am not so certain that this bisulphide of mercury, which I believe is the coloring-matter, is deleterious, but I certainly do believe that the vulcanite plate that has no coloring-matter in it, and where the surface that is in contact with the gum is made clean and smooth; in other words, made to be as nearly smooth as the same surface of a metallic plate,—and it can be made so,—that that plate can be kept clean if the patient chooses to do it. Unfortunately many patients after a little time lose their interest in that subject which is next to godliness. Most of them are a good deal more godly in appearance than they are in actual cleanliness, and their plates show it. Many of us have seen with disgust how some people will take their plates out of their mouths and stick them back again under conditions that would make one shrink. If they would keep the things clean, there would be fewer and perhaps no sore mouths,—I believe no more than there would be in wearing any kind of artificial dentures.

The question is cleanliness, and it is only that. Now, why do dentists leave their work in such an unfinished state? The main reason that I can imagine is, because they are getting so small a price they cannot afford to spend the time. They will make a set of teeth

while you wait. If you will wait long enough so will I, but you would have to wait from the beginning of the week until toward the end, while others will keep you waiting only until dinner-time. But another reason is this, that the plate that has all that irregular and roughened surface has actually a better adhesion to the gum. That is a fact. It adheres better in that way, but it is dreadful on the patient.

DR. LAND: If the patient will take an ordinary tooth-brush, and brush the mouth out twice a day, it does not matter whether the plate be of rubber or gold or platinum, the friction will cure the disease. It has been my experience repeatedly, and I have patients wearing rubber plates with as much comfort as any other dentures. There need be no further argument about it. That is the remedy. If there is indication of sore mouth, remove the denture, and allow it to remain out of the mouth for a few days, and the mucous membrane will invariably be cured, because the action of the tongue and the air will restore it to its normal condition. It is the absence of the usual friction of the food, the tongue, and the action of the air that causes the mouth to become tender.

SECTION I.—Continued.

Supplementary Report on Dr. Knapp's Bridge-Work and Blow-Pipe.

By W. B. AMES, Secretary of the Section.

SECTION I desires to make a supplementary report in order to make prominent mention of the processes and appliances of Dr. J. Rollo Knapp, of New Orleans, which have been shown to the members in his various clinics during the past two days.

We consider that in perfection of detail and in the consummation of really artistic effects, his methods of constructing crowns and bridge-work are worthy of this mention. Instead of stereotyped results in which there can be but little individuality or taste displayed, his methods produce by simple yet exact stages porcelain faced or all-gold crowns that will admit of very little criticism if the processes which he advocates are imitated by the skillful and careful manipulator.

His very unique and original blow-pipe, with which he utilizes the compressed nitrous oxide gas in connection with illuminating gas to produce what is practically an oxy-hydrogen flame, promises to be one of the most useful appliances ever offered for dental laboratory use. It is a matter of congratulation that we are soon to be able to procure the apparatus from the manufacturers.

DISCUSSION.

Dr. Knapp: I would say that I had do idea that any such action as this would be taken by this body. My specimens of gold and porcelain-faced crowns and bridge-work, as well as my blow-pipe, are not here, but in my rooms at the International Hotel.

At Nashville, Dr. J. W. White requested me to write a detailed description of my various methods and processes, and to send him my specimens of work in order that cuts might be made therefrom. Such article will doubtless shortly appear in the *Dental Cosmos*.

DR. KINGSLEY: I like the modesty of the young man, and I sympathize with him, for I was once young myself, and I remember with what hesitation and diffidence I would get up before a body of brilliant men to address them. I am therefore willing to step forward and take his place, though not by his request. I am only paying a debt that I owe, for when I was of his age, I was brought to the front in a way for which I shall never cease to be grateful; as I obtained a recognition of merit from my superiors, so do I like to bring my juniors forward and give them credit. Dr. Knapp has done some of the most wonderful things I have ever seen in dentistry. I sat here all yesterday afternoon listening to descriptions of an operation which I had heard over and over again, had read about in all the journals, and had seen demonstrated frequently. I saw how a peculiar method of filling a tooth was magnified into an excessive importance, which was after all only another way of arriving at the same result that had been attained in various ways for forty years, while to my mind it was questionable whether the new way had any advantages over already established methods. While our time was being taken up in this way, I could not but reflect that I had seen in the other room an exhibition of some cunning workmanship that was so far in advance of that which was occupying our attention, that we were only wasting time. Dr. Knapp is both a discoverer and an inventor. He has invented a system which I believe will revolutionize, to a very great extent, that branch of dentistry which some of you affect to ignore. I am ashamed of my profession at times when I hear them talk in such a sneering way of the mechanics of dentistry, while they are earning all their living, with the exception of a few dollars, by performing nothing in the world but mechanical operations. The filling of a tooth is nothing but the *mechanical* treatment of caries. You cannot ignore mechanics except in your words, for in practice you are depending upon it for your daily bread. This branch of mechanics has been developed and carried to a state of perfection by Dr. Knapp to which nothing in dentistry has ever before attained. The beautiful work which this young man has shown here as the results of his methods would have been almost impossible to accomplish by any other means. One of his inventions is combining nitrous oxide gas with illuminating gas, and producing effects which are something marvellous. Every man interested at all in the arts who witnessed for a moment what Dr. Knapp did with this compound blow-pipe must have been astonished as well as fascinated. Let us examine

some of the results. Naturally I was pleased to see my pet methods adopted and carried to such a state of perfection. It makes no difference whether certain things which I did were done before those of Dr. Knapp, it was more than gratifying to see him with his cunning hand adopting these methods which I had for years maintained were the best for the purpose. I refer now particularly to the manufacture of gold crowns, and the combination of porcelain with gold crowns. Confining our attention for a moment to gold crowns, we find advertised in our dental journals and by individuals gold crowns already made, also ready-made bands and separate grinding surfaces stamped up, which are intended to facilitate, on our part, the introduction of these valuable prosthetic organs; but I have maintained from the beginning that gold crowns, stamped up, cannot, except by accident, reach the perfection of adaptation, either to the root or to the occluding opposite tooth. My young friend tells me he has more than 275 metallic dies, copies of so many different grinding surfaces of natural teeth, which he originally prepared, so that he could select, as occasion might require, the one best adapted to a particular case. He found them of no avail. He cannot use them. They are like the ready-made crowns of the market,—they do not fit. They will answer to put in, but they are not a perfect adaptation. I believe the only true principle, the same which he has carried out, is this: first, make the band and fit it to the root before the cap which forms the grinding surface is attached, and thus while it is open you can see whether it is correctly adapted, and this you cannot know unless you do see it either with direct vision or by the aid of a magnifying mirror. The next step in Dr. Knapp's process is identical with mine, viz: to build up with wax or any other plastic material you choose, and model into shape the crown, giving it exactly the contour that belongs to that tooth, and to meet its occluding opponent. By the most simple method that I think I ever saw Dr. Knapp produces in a very short time,—within a few minutes even,—a metallic die which will swage up all the peculiarities that it is necessary to have in the grinding end of the crown. It is not a difficult matter for anyone skilled in the working of gold to adapt the cap which has been stamped up to the band that has already been fitted. We could do that with our old process; but his compound blow-pipe and his simple arrangements, using a little plaster and marble-dust for an investment, enable him to do in a few seconds as much as we by our old methods could do in the same number of minutes. The power and the control of that blow-

pipe are one of the marvels of the time. The heat is so great and under such control that one of the platinum pins in a porcelain tooth can be melted down into a button while its mate is left untouched.

No words of mine can express my full admiration of what Dr. Knapp has accomplished, and I hope that I shall not be the only one to pay him his just tribute.

DR. ABBOTT: I was invited into Dr. Knapp's room yesterday to examine specimens of his work, and to see the operation of this to me wonderful blow-pipe, and I will say, the results that he showed, and the manner of producing them, not only astonished, but delighted me. The apparatus is so compact that it could be put into a satchel and carried anywhere, and can be operated wherever ordinary burning gas is to be had. I was so pleased that it was difficult to find words to properly express my feelings. I wish every one who takes the slightest interest in mechanical dentistry, and I hope everyone does, more or lest, could see and understand these things as I felt that I did yesterday.

SECTION IV.

OPERATIVE DENTISTRY.

REPORT BY E. T. DARBY, CHAIRMAN.

SECTION IV, Operative Dentistry, begs leave to submit the following as its annual report:

Since we last convened another year has passed into history and although nothing of a startling nature has been developed to interest this Section, it has afforded added experience with the methods and materials already in use.

It is sometimes the part of wisdom to loiter for a moment in the busy highway of life and count the milestones which we have passed, and consider the objects of interest which have surrounded us in our pilgrimage.

The American Dental Association has been in existence for a quarter of a century. It has been in a certain sense the exponent of the methods and materials which have been employed in the treatment of dental caries, and although its opinions have not been expressed or enforced in an arbitrary way, it has nevertheless exerted a powerful influence upon the profession at large. The progress which has been made in operative dentistry during the past twenty-five years is truly wonderful. The improvements and changes have followed one another in such rapid succession that we have learned to expect something new and startling almost daily. Could we enumerate in their order and even in rapid succession the various methods and appliances which have been introduced and intended to facilitate the preservation of the teeth during the past quarter of a century, more time would be required than is usually granted for a report from this Section. Change is not always improvement. There is a conservatism which has for its mother wisdom, and although we sometimes laugh at the man who is slow to change his old methods for new ones,

we often learn by sad experience that new things are not always true things.

Twenty-five years ago the profession was almost a unit in its abandonment of non-cohesive or soft gold and in substituting therefor cohesive foil. The pendulum of experience has swung to its utmost limits, embracing within its radius every gradation of heavy and light foils and all degrees of cohesiveness, until it has finally settled to a medium both in thickness and cohesive quality. Many have returned in a measure to the use of the old-fashioned soft gold, using the other only for hardness of finish or for restoration of contour.

Unquestionably great improvements have been made in the preparation of gold. The Wolrab gold, made in Bremen, has attracted the attention of many in the profession during the past year, as has also the "Velvet" foil made in this country.

We are at the present time interested in the methods of one who, though a foreigner by birth and dental education, has come to America for the sole purpose of demonstrating a method which bears his name, and which has some features which may commend it to practitioners here.

Twenty-five years ago the dental mallet had few supporters, although its value was being publicly promulgated by Dr. Atkinson, of New York. To-day it is in the hands of almost every practitioner, and in one form or another is regarded a great improvement in dental practice.

Twenty-five years ago dental amalgams were few in name and few in formula. To-day they are not less than fifty in name and manifold in kind. Are the new better than the old? Has value attended the change which has been made?

Twenty-five years ago the conservative treatment of the dental pulp was practiced by few, partly in consequence of the difficulty which attended the operation, and partly because of the discouraging issue which attended such efforts. Since then oyychloride of zinc and other preparations of a similar nature have been introduced, and many pulps are now conserved. While the successes have been many, the failures also have been numerous. Is the profession united in its estimate of the value of oxychloride of zinc as a capping for dental pulps?

Twenty-five years ago the profession was a unit in the belief that gold was the best material with which to save the human teeth, and many of its members have gone to their graves strong in the faith. Since then apostles of a new doctrine have arisen, and have promul-

gated the theory that gold is the worst material with which to save teeth. Does the American Dental Association of to-day believe that amalgam and gutta-percha, oxychloride and phosphate of zinc are better than gold for this purpose? Have the observation and experience of honest men convinced them that the plastics are better, or is the belief again gaining ground that just in proportion as teeth need saving, gold is the best material with which to save them?

Has not the profession learned that notwithstanding all that has been said in favor of the plastics, and all that has been done up to the present time in the way of improving their character, we are to-day just about where we were a quarter of a century ago, with but one truly reliable material?

Twenty-five years ago the rubber dam was unknown in dental practice, and although it is regarded as one of the greatest boons that the profession has ever known, and its unselfish inventor lived and died with the appreciation of his fellow practitioners; yet there are many who regard it as an unnecessary and disagreeable thing, and go so far as to assert that it and the clamps and ligatures which accompany its use are the most prolific cause of pericementitis and kindred lesions. Does the profession of to-day fully appreciate the value of this, the greatest invention which has been given it in the past two decades?

Twenty-five years ago dental engines or mechanical drills were unknown, and the dentist wearily did in hours what he now accomplishes in minutes. The inventive genius of the profession has done much to perfect the various mechanical appliances, and to-day the dental engine is generally regarded as one of the most important aids in operative dentistry, and yet there are some who look upon that instrument as one of the most pernicious and destructive to tooth-structure, even going so far as to assert that thousands of teeth are yearly sacrificed by its use. Is the dental profession of to-day of the opinion that the dental engine has been a curse rather than a blessing?

During the past twenty-five years the subjects of permanent separations and the restoration of contour have been frequently agitated and earnestly discussed. That the first of these has been largely practiced and the result largely disappointing, I am sure the Association will agree.

Is not the profession of to-day strongly of the opinion that the restoration of contour in the great majority of cases is the better practice?

As yet no papers have been submitted to the Section for presentation here. A few appliances have been offered with the request that they be presented to the Association. An improved band matrix by Dr. T. W. Brophy. A diamond tool for cutting or shaping corundum disks, by Dr. Fernandez. A new attachment for dental hand-piece, by Dr. S. G. Perry. An ingenious attachment to matrices for holding rubber dam in place, by Dr. Swasey, of Chicago. A set of delicate trimming or finishing instruments for amalgam fillings, by Dr. S. C. G. Watkins. Dr. Watkins also has a tooth-brush to show the Association.

DISCUSSION.

DR. HERBST: I came to this country upon the invitation of several dental colleges and societies to show some improvements which I have made in packing gold into cavities of the teeth. The gold is brought into the cavities by means of burnishing it against the walls with engine instruments, in which way you will be able to obtain a very much better adaptation to the walls of the cavities than by means of the mallet. Of course, everything depends upon the cavity. Every cavity which does not have four walls must be made into such, and the method of doing this I have exhibited in the clinics given. The improvement, I think, is a very great one, so far as the patient is concerned, for patients will certainly notice a great difference between the introduction of the filling by this method and by that of malleting. All the qualities which a first-class filling should have which has been introduced by the use of the mallet should be expected to be present in fillings which have been made by rotation;—namely, the weight of the filling, the adaptation, the intimate union of the several layers of gold, and the amount of time required for the introduction.

I have come to this country because I know, and everyone knows, that in America the best men of the dental profession in the world are to be found, and they will be honest and generous with me. In Europe I have shown it to a great many of my confrères, but they have done very little with it. Of course, there are many of you in this country who are operators such as cannot be produced in any other country. They are great men, and they can do with their methods a great deal, probably more than I have been able to do, but at the same time a great deal can be done by this method. The introduction of the filling-material, I think, is very much easier, and the method can be acquired by men having less skill than

is required for the malleting method. I do not believe, and I do not hope, at least for the present, that the method of malleting gold, especially upon the last layers of the filling, will be abandoned, for I indorse what Dr. Bödecker has said in his writings, that it would be very much safer, especially for beginners, to use the mallet upon the last layers in the filling.

I can say but little to you here. I could show you a great deal more. Speaking about it will not help you very much. One thing I can call your attention to: be very particular in the first layers of the gold which you introduce into the cavities. If I can show to you something of what I have brought here in the way of operations, I shall be very glad to do so. The only trouble is that I am going away so soon. I shall be obliged to leave to-night, but although I am going away, I know I have not been here without doing some good, for there are some who have comprehended the method thoroughly, and I shall entrust to them the showing and teaching of it to others.

I beg you not to throw this method entirely away without trial. I know that for your own benefit, as well as for that of your patients, you will derive considerable satisfaction from it. I see here a great many of the best operators of the world. Most of them look fatigued and worn out. I think if they would practice this method they would not have to work so hard. They can save labor and, at the same time, do the work much easier than by the other system.

Next year, gentlemen, I hope to see all of you again in Washington at the International Medical Congress.

Dr. Ottofy: I would like to have Dr. Herbst state in a few words just what advantages he claims for his method over our usual practice. We now have gold prepared in various forms and have various methods in filling. In what respect is his method better than those which we follow?

Dr. Bödecker: Dr. Herbst says that I know all about his method, and it would be much easier for me to describe it and to answer questions than to translate what he says. I will therefore take the liberty of answering in as few words as possible.

I think there is an advantage in this method. In the first instance, I claim that the adaptation of gold against the walls of the cavity is better than can be obtained by any other method that I have ever seen. I have proved this in New York at a clinic to the satisfaction of everyone that saw it, as well as by experiments which I have

made in my own house, and those together with Dr. Herbst two or three years ago. That is one of the greatest advantages. The adaptation of the gold to the walls of the cavity, I think, saves the teeth in every instance. If you take a piece of gold and hammer it against a smooth surface (it does not make any difference whether you take steel, glass, or any other hard substance), and afterwards subject it to examination under a microscope, you will find the adaptation to that wall is imperfect. It does not make any difference what method you use, how much force you apply, you will not get an absolutely perfect adaptation. On the contrary, however, if you take a piece of soft gold, and pack it against the same surfaces by a rotating instrument in the engine, and then examine the surface under the microscope you will see that you have an absolute fit to the wall of the cavity. For this purpose a piece of glass will show you better than anything else. You can take a pretty thin piece of glass tubing, rotate a piece of gold against the walls and examine with a microscope and you will see that its adaptation is perfect. You can take the glass tube and put it into a solution of carmine or aniline, and you will not be able to get any discoloration between the gold and the glass; but with malleted plugs, however carefully made, a very thin solution of aniline will in time percolate through.

That is one of the great advantages, I think, of this method.

In a certain class of cavities, at least one-half of the time will be saved. Those are cavities in the approximal surfaces of the molars and bicuspids. Everyone knows that such cavities, sometimes extending under the gum, are exceedingly difficult and tedious to manipulate. By this method, as a general rule, the most difficult operations with which we have to deal are rendered the simplest; but the uppermost portions of the cavities, or the last layers in the grinding surfaces, are somewhat difficult to adjust. Therefore I have advocated adapting the last layers with the mallet. I think the result will be better, and it will be very much easier for those who are accustomed to that method. Another great advantage is that the patient who has had teeth filled by this method will certainly ask you to use it in preference to the mallet. I have had several operations performed in my own mouth, and all those who are present who have experienced both methods will bear me out in saying that the Herbst method is a very great improvement, as far as the patients are concerned.

DR. ATKINSON: I think that the Herbst method will not be complete until Dr. Bödecker has given us his obtunding process.

DR. BÖDECKER: I think it is of the utmost importance to the dental profession that they should know about this obtundent. More than a year ago, when I was in Europe, Dr. Herbst showed me this obtundent. At that time I was a little careful and did not know whether I should dare to bring it out, but since I have experimented with it I can say that I think it is safe. The obtundent consists of chemically pure sulphuric acid saturated with hydrochlorate of cocaïne, which is added while stirring it with a glass rod, until it is perfectly dissolved. (This at the same time is a test for chemically pure cocaïne. If the sulphuric acid remains uncolored, the cocaïne is pure. If the sulphuric acid gets dark, it shows impurities.) Then to this solution of sulphuric acid and cocaïne you add sulphuric ether to the point of supersaturation, stirring it with a glass rod, not shaking it, because if you shake it and put a cork in the bottle, the expansion is very great and the bottle may break; therefore it is much better to do it in a long test tube and to use a glass rod and stir it while adding the ether. The ether which is not taken up by the sulphuric acid will be on the top of this fluid and has to be evaporated by means of a chip-blower or by standing. A little of this is then taken on a piece of cotton and applied to the cavity of the sensitive tooth. The effect is really beautiful. I have had it applied it to four of my own teeth and I am satisfied that it does the work nicely, more so than any other obtundent that I ever used. It cannot obtund the whole of the cavity at once, but it will only obtund a certain layer, and you will have to reäpply it, but the action is so rapid that usually within two minutes after the application is made excavation can be proceeded with.

DR. TAFT: It was my privilege about a month ago to spend three days with Dr. Herbst and witness his methods. In regard to this obtundent, I will say that it impressed me as a questionable preparation when my attention was first called to it. Immediately upon returning home I had the preparation made. It consists of sulphuric acid saturated with cocaïne; and in that experiment we found that one drachm of sulphuric acid dissolved thirty grains of crystals of cocaïne; then add about one-fourth of a drachm of sulphuric ether. The amount of sulphuric ether applied is not important, enough simply to saturate the solution. I have used it in quite a number of cases, and in every instance, unlike most other obtundents with which I am familiar, it has been successful. Whether that was owing to the properties of the material or was the accident of peculiar cases during this time perhaps may be a question, but my impression is that

it is of the most general efficiency of any obtundent I have ever used. The action is simply that of the sulphuric acid upon the dentine, dissolving a portion of it, but is superficially escharotic on the living tissue. The influence of the cocaïne is to obtund, as Dr. Bödecker has said, the sensitiveness caused by the action of the sulphuric acid. The ether is, as I conceive, for the same purpose, simply to relieve the pain that would be given by the application of the sulphuric acid alone. After the application, the cavity having been dried, the decomposed bone appears upon the walls of the cavity.

In regard to the method of Dr. Herbst, while it perhaps may not become one of general adoption in all respects, it certainly has many features that can be employed and utilized in almost every man's practice. In order to make the most of the method, it is well that everyone should study it as thoroughly as possible. Equal facilities have not been enjoyed by all to see the performance of the operation by Dr. Herbst. Those who have seen him operate should study it well and communicate it to others. It will be difficult in this, as in any other process, to learn from printed statements or instructions, but an intelligent person, witnessing the operation in the hands of Dr. Herbst or Dr. Bödecker, or others who have become familiar with it, will derive ideas and suggestions that can be readily utilized in their present methods that will certainly be of great benefit.

As the matter has been presented in print heretofore, there were various objections suggested, and in many instances the whole thing was condemned because of a want of knowledge of the process, but witnessing it and learning from those who can perform the operation well, there is very much that will aid anyone. I have no doubt that many will adopt the method to a large extent in filling many forms and varieties of cavities. In large cavities, where much excavation is not admissible without weakening the walls, the Herbst method is especially applicable, as by the ordinary method of filling such cavities special anchorages or retaining points are necessary; but by Dr. Herbst's method such retaining points are not necessary. Condensing large masses of gold into such cavities by the ordinary plugger and the mallet is done with difficulty, and imperfect work is very likely to result. By the Herbst method the adaptation is much more easily and perfectly made in such cases.

I was very much interested in witnessing Dr. Herbst's method of consolidating the first portions of gold in the cavity under a pledget of cotton. By this means the cavity may be lined throughout with gold or tin, as the case may be, and then filled by any method

preferred. This mode of securing a foundation for the filling is in many cases at least very valuable. In such cavities various methods have been employed. Sometimes a large mass of gold is packed down into the bottom of the cavity. Those who have operated in this way readily understand the difficulties that attach to it. It is not easy to press down a large mass of gold in this way and have it thoroughly adapted to all parts of the cavity; while condensation is being made at one point, withdrawal upon another will occur, and so it is very difficult to make a good adaptation in that way. Another method has been to place a small portion of gold in the cavity and hold down one point or portion while other parts are being consolidated.

DR. MARSHALL: I happened to be a patient of Dr. Herbst during his clinics here, and perhaps some of you would like to know how the patient feels under the rotatory system of plugging with gold. I can only speak from the patient's standpoint. First, let me say, I prefer in my own mouth the method of Dr. Herbst to the mallet. It is certainly much more pleasant, and I did not suffer one-half what I have done by the use of the mallet. He plugged for me two teeth, a crown cavity in the left inferior second molar, and a compound cavity (distal and grinding surfaces) in the left inferior second bicuspid.

The amount of pressure which he used in packing the gold was considerable, about the same as used in packing cylinders by hand-pressure. I found that after a little while my jaws became very tired from the heavy pressure which he used, and I was obliged to support my chin during the balance of the operation. The motion which he used in packing the gold was peculiar,—viz., heavy pressure and a drawing motion towards the walls of the cavity. This produced an unpleasant sensation whenever the instrument came up against the walls of the cavity. I thought sometimes the wall had been broken, but those who were watching the operation told me this was not so. Aside from this, I can say nothing, because I did not see the operation.

DR. ATKINSON: When Dr. Bödecker first introduced this method, he wrote to me saying that he had witnessed a method of filling teeth that had captivated him, and that he was sure it would me. The affection I bear Dr. Bödecker made me almost assent to it by letter. But having been so thoroughly indoctrinated in my own experience in the use of the mallet and heavy gold, and thinking that I did not need anything else to make the best possible fillings,

I said, now go slow; and it took me all the time from the time I got his letter until since the arrival of Dr. Herbst to really comprehend the process.

I have witnessed sixteen clinics, four of which I was able to see from the beginning all the way through, and one of which was in my own mouth, so that I understand it at both ends, and I give it my adhesion, stubborn as you say I am, bull-headed, and wedded to my own methods, which are not my methods, but those that are given to me from higher sources.

I tell you I have a new revelation. For hardness of surface I know of no method that touches the rotary method as a surface-finishing method. I have tested fillings made by it with files to my own satisfaction, and know that they are the hardest that I have ever seen packed. When he was in my office my son suggested to him that he might try his method upon No. 120 rolled gold. He tried it and succeeded beautifully, and adapted it to the wall of a tooth in the jaw of a skeleton they had at hand. My son said to him, "We have what father is in the habit of using for teeth where much wear comes upon them, platinum iridium and gold," and he used that and succeeded with it. Those who try it at first and don't succeed must not be discouraged, but go to some one who has been indoctrinated in the method, and, as Professor Taft has properly said, they will catch many little points in observing the combined process of rotation and of pressure at the same time. The rotary movement, I had supposed, would be so rapid as to cause elimination of heat and be a source of inconvenience and discomfort to the patient on that account, but that is avoided by a peculiar twist of the wrist, thumb, and forefinger, so eminently possessed by Dr. Herbst, and by the slowness of the motion, and direct shock is not produced. I think anyone who has been accustomed to filling teeth by hand-pressure alone can by a little bit of education direct the same genius and energy into packing the gold towards the wall. I felt the same that was expressed by Dr. Marshall, the instrument would slip a little, especially when he was using the agate point; but let me say to you, if I never see you again, try it until you comprehend it, and then I prophesy you will not abandon it.

DR. MARSHALL: Dr. Atkinson spoke of friction and the production of heat. In the filling of the cavity in the bicuspid I experienced nothing of that kind. In the filling of the molar I did. Gentlemen were frequently examining the progress of the operation, and by some mishap the filling from moisture lost its cohesive property, and

several gentlemen said that it would have to come out. Instead of that, Dr. Herbst took a steel instrument and with heavy pressure and fast rotation he produced considerable heat, so that it pained for a moment pretty sharply. He then annealed a piece of gold and put it on that point, and it cohered at once, and he went on and finished the filling.

DR. REHWINKEL: A sense of gratitude to Dr. Herbst impels me to say what I know of this method. About three years ago, at the annual meeting of the Ohio State Dental Society, a number of the *Deutsche Monatsschrift für Zahnheilkunde* came into my hands. Among its contents was an account of a clinic given by Dr. Wilh. Herbst before the Frankfürt Dental Society, in which the "new method" was described and demonstrated by its originator. A hasty perusal of the article, portions of which I translated for Drs. Taft and Butler, was sufficient to interest us, at least theoretically, in Dr. Herbst's method. Upon my return home, I re-read and studied carefully the article in the *Monatsschrift* and afterward translated and prepared from it an extended synopsis of method and manner of procedure for the *Ohio State Journal of Dental Science.*

With increased interest in the subject, I commenced experimenting, beginning with tin and following as best I could the directions set forth in the demonstrations of Herbst. I worked with this metal until I could manage it fairly well, and then ventured upon the use of gold. After considerable practice, I could make to all appearance a good filling, which stood satisfactorily the applied tests for density and adaptation. I found great difficulty in manipulating the last layers, and for these was compelled to resort to the mallet, proceeding in this way until I could produce a good filling in all the usual cavities. I had, however, a feeling of doubt as to the durability of my work, and having no standard with which to compare it, could not be sure that I had fully comprehended the method. At this time I wrote to Dr. Herbst, asking him to be kind enough to send me some specimens of his own work in different teeth, progressive steps in his mode of operating. For instance, one tooth with cavity prepared; another with the first layers and anchorage of gold; another with the work further advanced; and lastly a completed filling.

He replied at once with the charming readiness to assist anyone interested in his method which I have since learned is characteristic of the man, and a very short time after sent me even more than I had asked for,—not only the prepared teeth, but also some of his own instruments and matrices. With this additional aid and information

I felt assured that I had been proceeding in the right direction, and was encouraged to make further use of the method. When Dr. Herbst came to America and Dr. Bödecker was kind enough to invite me with many others to meet him in New York and see him operate, I most gladly availed myself of the opportunity to do so. In the interval since I first heard from Dr. Herbst he has greatly improved his instruments and made rapid progress in the perfecting of his method. I will not repeat what has been said by the gentlemen who have preceded me. But I can indorse every word of theirs, and most especially those in reference to the effect of the obtundent. Like Dr. Taft, upon my return from New York I had a preparation made after the formula given by Dr. Herbst. I have been using this whenever occasion required with very gratifying results.

As a fellow-countryman, permit me to express the pleasure I feel in the kind reception and recognition Dr. Herbst has received at the hands of the dental profession in America.

Dr. Bödecker: If I may be permitted to speak again I will allude to a few of the principal points of the Herbst method, which I undertand have been misapprehended. One of the principal advantages in filling by the Herbst method is that every complicated cavity is converted into a simple one with four walls, by the use of matrices. With reference to the manner of the introduction of the gold, the cavity is prepared in the usual manner, just as you would prepare it for any other method, and shaped without any sharp undercuts. If the general shape is sufficient to hold the filling, it is all that is necessary. When the cavity is prepared and the proper matrix is applied, you take a few large cylinders of gold, say for an ordinary cavity of a bicuspid from three to five large cylinders, and introduce them with a hand plugger like Herbst's hand instrument, as large as the opening of the cavity will permit, with which while rotating it in the hand the gold should be pressed down into the bottom of the cavity. If the gold lies quiet it is all right, and you proceed with the engine burnisher to burnish it down tightly. If the cavity is very large or shallow so that there is but little undercut, and you do not like to make any, the way Dr. Taft has alluded to is a very good one; that is, to cover the first layer of gold with a piece of cotton, using the rotating burnisher upon the cotton to condense the gold beneath it. When this is done the cotton is to be removed and the gold further condensed by means of the rotating burnisher used in the engine directly upon the gold. The cotton is held by another instrument or a finger so that it does not revolve, and the

rotating instrument is pressed upon it with a great deal of force, moving over the whole surface of the gold. Then take a large agate instrument, when the cavity will admit it, and with this press very tightly against the gold, running the engine not too fast, and at the same time moving or rubbing it from side to side. When this has been done an exploring instrument is made use of which has a very fine point, and with this every portion of the surface of the gold is to be examined. This instrument will show exactly every place that is not perfectly condensed, and wherever the instrument sinks into the gold this has to be recondensed by a finer rotating instrument, either steel or agate, in the engine. When the condensation is complete, it is much better to roughen the surface of the gold, and this is done very nicely with an old excavator which has been broken at the point. Dr. Herbst uses this for two purposes, namely, as an exploring instrument, and at the same time to roughen the surface so as to make the next layer of gold cohere. This can be done as well by using the steel rotary instruments in the engine. If steel is employed, this roughening of the surface by means of the broken excavator is unnecessary. When this has been accomplished the next layer of gold can be put into the cavity, and so on until the operation is complete. In the last layer it is very much better to use heavier numbers, as the thin numbers (Nos. 4 to 10) of foil, as a general rule, will not produce as good a surface as heavy foil (Nos. 20 to 60). I called Dr. Herbst's attention to that last year when I saw some of his fillings which had become a little rough upon the grinding surfaces. But these fillings were smooth at the approximal surfaces. Some of these fillings had been in the mouth two, three, or four years. At first, Dr. Herbst thought he could not use heavy foil with his method, but he experimented and found that he could use No. 10 very well. He did not go any further at that time, but since he has been in this country I asked him to use No. 30, which he did, and since that time he uses that number on all grinding surfaces. Before using No. 30 the surface ought to be made rough, either by a rotating instrument, a hand plugger, or a broken excavator. I have heard some gentlemen say that the Herbst method was nothing else but hand-pressure. But this is only used to put the gold into the proper place, where it is wanted. The condensation is effected by means of an agate or a steel instrument in the engine. In the last layer, when applicable, Dr. Herbst makes use of a garnet, which was originated only three weeks previous to his departure from Europe.

It is surprising how hard the surface of the gold gets, as Dr. Atkinson has stated. The surface of the gold becomes so hard that the ordinary corundum stone sometimes refuses to get hold of it in finishing it off.

For general information I would advise those who desire to learn more than they have heard here, to read what has been published previously in the *Independent Practitioner.*

Dr. Peirce: It has been my pleasure to witness three operations performed by Dr. Herbst, and I feel satisfied with the results, and consider his method one worthy of serious attention, and while many of our older men, or probably most of them, would not adopt it, it certainly behooves the younger ones in the profession to examine it and see if they will not obtain from it that which will be of great advantage to them in after years. They should not be discouraged with the want of success which may attend the first few efforts. It is well to remember that Dr. Herbst has been working at this process for seven years, and it is only within the last six months that he has performed the more difficult operations in a manner at all satisfactory. He has only recently felt disposed to go abroad and devote his time to the enlightenment of the profession. I would suggest a method by which those so disposed could make themselves familiar with the practical part of the process, viz: procure a piece of bone or ivory sufficiently large to be held firmly in the hand, and in this with a little bur in the engine make a superficial cavity with a proportionately large lateral diameter. Around the margins of this cavity make a decided though superficial groove or undercut, with a few retaining points. In this cavity with a pair of pliers put gold pellets or cylinders sufficient in number and size to cover the floor of cavity and groove. Now, with a firmly rolled pledget of cotton on this gold apply the rotating burnisher, and you will soon have a most admirable illustration of how thoroughly the rotating movement will condense the gold cylinders, not only into the groove, but into the minutest inequalities in the floor and sides of the cavity. Piece after piece may now be added, and with the application of the same force the filling may be built up above the walls of the cavity, and indeed to an almost unlimited height. The process practiced in this way will make the operator familiar not only with the method, but with the results which may be attained with this rotary force.

Dr. Watkins: I think it is due Dr. Herbst and Dr. Bödecker to say one word in regard to the solidity of the gold put in by this

method. I have a tooth in my own mouth which was partly filled with the bloodstone instrument when very little pressure was used. That was the first stone made for filling by the revolving process, and I suppose the first tooth filled by that process in this country. I am thoroughly satisfied with the operation, and with the way the filling wears. The filling includes the anterior approximal and grinding surfaces of the left superior wisdom-tooth. The second molar being absent, this tooth has a great deal of work to do, and does it well, without any perceptible wear on the filling.

DR. BÖDECKER: Not all of that filling was put in by the rotary method. I used several layers of gold which were put there with the mallet.

DR. WATKINS: The first part was put in with the mechanical mallet, then the lead mallet, and the automatic, and finished with the bloodstone, and the bloodstone was much less painful and disagreeable.

DR. BRYAN, of Switzerland: The great stumbling block to all who have tried the Herbst method in anything but the very simplest cavities, has been the difficulty of adapting matrices which would remain solid in place. I have experimented with various materials, and recently have come across a preparation of steel which clockmakers use for supporting pendulums, as thin as paper, the twelfth of a line, French measure, which can be cut with little scissors or shears, like paper. From this ordinary ring matrices are made, which are adaptable in all cases between teeth, wherever you can get the floss silk.

DR. BÖDECKER: I have the same article here which I brought over three years ago. Dr. Herbst has been using them ever since.

DR. BRYAN: The Herbst method has been tried in Europe. A great many like and a great many condemn it. The public sentiment is against it, but there are a great many good things about it, evidently.

DR. CROUSE: For my own part I am not a convert to the Herbst method of filling teeth. I examined one filling that was being made by Dr. Herbst at two different times during the operation. The first time between the filling and walls where there was an overhanging wall, a sharp instrument would pass between the gold and the walls of the cavity sufficient to stick fast between them, showing that the gold was not well condensed at that portion. Further on in the operation, and when nearly completed, I examined it again and found the gold more perfectly condensed, and yet not as well condensed as it would have been in a good operation by our present method. I don't believe the principle correct. I don't believe the plan of condensing

gold by the rotary motion as likely to make a perfect filling in every respect as the mallet or the wedge principle. I should not have faith enough in that plan of operating to even give it a trial, were it not that so many good operators favor it and are even enthusiastic in their praise of the method. I shall, however, give it a trial and a faithful one, to satisfy myself whether or no there is any advantage in it. It has been a great pleasure to me to have seen Dr. Herbst operate, and to meet one so fertile in plans for performing different operations and who brings us so many ingenious appliances for simplifying our work. Dr. Herbst has unusual dexterity as an operator, and I judge would fill teeth well by either method. The only danger that I apprehend is that others not equally dextrous will fail for lack of this in attempting to follow his method. I hope, however, that we shall thoroughly test the method and find much good in it.

DR. MORGAN: We are apparently in our infancy in regard to the science of metallurgy. There are many things about gold that we do not know. Those of us who have been investigating the subject for a good portion of a lifetime find that there are many points that when we are questioned upon them, we have to answer, "I don't know." In the early portion of my life I was accustomed, whenever opportunity occurred and I visited cities where there were gold-workers, to spend a portion of my time with them, and I learned then that no man among all the gold-beaters that I met claimed to be able to produce uniform results. They would, for instance, prepare an ingot of gold to be made into foil and roll it out into a ribbon, and place that in a safe, and on Monday morning they would cut off a piece and give it to a gold-beater, who would bring in in the afternoon two or three ounces of foil that was exactly right. Tuesday morning another piece would be cut from the same ribbon and be given to the same gold-beater, and at night when the foil came in, it was not satisfactory. Beaten by the same man on the same anvil, with the same cushions and with the same hammer, he could not produce uniform results. What was the matter? The gold-beater did not know what was the matter. No man has told me why they could not produce uniform results.

Another point: Every man, I think, who used soft foil exclusively as long as I did learned the fact that gold was hardened by friction, when, as far as human judgment could determine, there was no condensation of the gold. You might take a gold filling, pack it in, cut it down to a given point, and with gently burnishing over it produce

a very hard surface, when you were confident in your own mind that there was no condensation of the metal, no driving together of the molecules. What was the reason? I don't know. I am positively assured in my own mind that the hardness of the soft gold fillings that I made exclusively for twenty years of my life was the result of friction upon the surface. Another fact: After you have introduced your gold in a crown cavity of a molar, if you use upon the surface a smooth-pointed instrument, either with hand-pressure or mallet force, so that the point slides over the surface, you will get a result that you cannot procure by direct blow and pressure. The same principles underlie this method. When friction is produced by the rotating burnisher, I think some electric action is evolved in addition to the pressure.

There are many things in this system to which I see objections from my present stand-point; but I have not investigated them sufficiently, and I propose to make a fair test before I condemn the method. There are some principles involved in this mode of filling teeth that are very valuable, and which we should bend our energy to elucidate.

DR. JAMES TRUMAN: The obtundent spoken of by Dr. Bödecker and indorsed by Prof. Taft will, I think, be productive of very great injury if its use be persisted in, and I assert this on general principles, as I have no special knowledge of the agent described. If an escharotic be used upon a surface of dentine to destroy sensibility, the effect is to destroy the fibrillæ to a certain extent, and as these are but prolongations of the pulp, the possibilities are that the irritation may extend to that central organ and cause its death. That this will result in the use of chloride of zinc has been abundantly proved, and why not in the use of sulphuric acid. While the action of these agents is not exactly alike, the ultimate effect cannot be very different. To my mind, there is great danger in its use and I was surprised that Prof. Taft should so thoroughly indorse it as he did. His assertion that the interior of the cavity, after its use, was left in a crumbly or powdery condition demonstrates the great disintegration caused by this agent.

I give these remarks as a warning, in order that this formula may not be taken down and carried home without due care in its future use.

In regard to Dr. Herbst and his process of rotation, two years ago, after reading reports of his process in the German journals, I tried to practice his method. With the knowledge I then had, my efforts

resulted in failure. When Dr. Herbst came here, I availed myself of the first opportunity to closely watch his operations. I found that either he had changed his methods or I had not comprehended them, very possibly the latter. Always willing to learn and to follow truth wherever I find it, I went to work immediately to practice this plan, not only out of, but in, the mouth, and within the last few weeks have been satisfied that I can place in fillings by this process in any given cavity as solidly as I need them. I mean by this that I use rotation to condense the metal, but do not strictly follow his method in other respects. I state this the more willingly for the reason that I am on record as having criticised his monograph on this subject, and I feel that in justice to him the more recent conclusions should be as publicly stated. It is not safe to affirm as yet that his mode will accomplish all that he claims for it, but it promises to be a valuable aid in the operation of filling. I have used the mallet on the last layers of gold, as described by Dr. Bödecker. This is not so much to increase solidity as to make a perfectly smooth surface, the tendency of the rotated instrument being to pit. This is probably due to want of skill in its use.

DR. BOGUE: Before this discussion is closed I would like to ask what the Herbst method is.

DR. BÖDECKER: I think I have defined in a short way how Dr. Herbst fills teeth and what the Herbst method is, and I don't know what else I can say to Dr. Bogue. The methods pursued in the introduction of the gold are simply these: Gold cylinders are placed in the cavity and pressed down by means of a hand instrument, so as to insure that they will not be rolled away by the rotating instrument. They are then condensed with the engine by means of the rotating instrument. If upon examination some points are found not thoroughly condensed, smaller cylinders are introduced into the imperfect places by means of hand pluggers, and again, by the rotary instrument in the engine, condensed thoroughly, and so on, layer after layer, until the cavity is finished.

DR. BOGUE: Dr. Bödecker fails to comprehend the question, and I take this occasion to say that I do not ask it in any spirit of antagonism, but quite the contrary.

DR. REHWINKEL: Perhaps I can throw a little light upon Dr. Bogue's question. Two years ago Dr. Herbst was modest enough to disclaim any wish that this should be called the Herbst method, preferring that it should be entitled the "German Method," and that arose in this way: In a conversation which I had with him he

said, the state of dentistry in Germany had reached that point that nothing in the way of home efforts for its advancement was being done; that they were indebted to the American profession for their ideas, their instruments, their gold, and in short everything, and he thought the time had come that something should be done to remove this reproach, and that Germany should herself originate something new and valuable for the dental profession.

To this end he studied and experimented for years in new ways of applying and condensing gold, and finally succeeded in producing a filling which gave him satisfaction. For a time he rested content with his ability to make a perfect simple filling.

On the return of his brother from America, who informed him that his discovery would not be recognized here unless he could also make contour fillings, he again commenced a series of experiments. Knowing that he could do nothing in this way without something to confine the gold on that side of the tooth where the substance had been lost, that he must have a wall against which to condense the gold with limited pressure, he tried the matrices, and all that followed was "simply a development." So that the Herbst method, in answer to Dr. Bogue's question, is a way of filling teeth with force applied by rotary motion instead of direct pressure.

DR. HUNT: Most of us who are living in the West have not had an opportunity to witness any operations of this character, and I would ike to hear from Dr. Perry, who has observed the work carefully.

DR. BOGUE: I asked the question of Dr. Herbst, which has been answered by two of his colleagues, because I felt that the principles underlying his method of operating had not been touched upon during the discussion. Dr. Morgan was the first to comprehend, and he has taken us back twenty-five years to the principles that were certainly taught me by Dr. Westcott. He again refers to them when he speaks of the curved burnisher giving results which can neither be obtained by the sharp point with direct action nor by the wedging process. A practitioner in Germany, far away from the United States, goes through many of the processes which ten thousand dentists in this country have tried, some of which we have laid aside. After careful experimentation, he eventually adopts almost the same principles that our most dextrous operators have adopted, and brings about the same results. I have seen him operate, and, as I understand the Herbst method, it is simply a convenient and accurate mode of adapting soft gold to the walls of cavities. This mode does not involve a single new principle of any kind, but it adapts various

new appliances. Our friend Herbst takes a thin spring of German silver or steel which can be passed between two teeth that are in such close contact that it is difficult to pass the silk. He puts this thin slip between them, draws it around the tooth with a pair of pliers, takes it off, solders it, and replaces it, and he has his matrix. Have we, in our work with wedges or burs, round-headed instruments or square-footed instruments, been able easily to adapt gold to the entire circumference of the cavity so as to be in exact contact everywhere?

Herbst takes soft gold, using hand-pressure largely to get it in position, and then puts in the rotating instrument. What is accomplished by it? Storer Bennett, taking his cue from Herbst, made gold fillings in seal rings and in a screw matrix, and claimed it was done by centrifugal force. Dr. Morgan brings out his statement, which is an extension of that idea. This much we know, that gold can be put into the depression in a seal ring, covered over with cotton, and that a rotating burnisher will in a minute or so give you an impression of the seal as good as wax will produce. If one can so adapt gold to the depressions in a carnelian ring as to reproduce the portrait on that ring in two or three minutes, with a rotating instrument, it seems to me that when we have learned how, we may equally adapt that soft gold to the corners formed by our matrices, and it will be as perfect a protection against the entrance of moisture as a cork in a bottle. If the grinding surface were at the same time sufficiently strong to resist the impact of mastication, the rest of the filling would be sufficiently hard to resist the influences that tend towards decay. One word more about contours. I have not yet gotten over the impression that I have no right to mar the natural form and perfection of the tooth. That to me is sacrilege. It can well be imagined, therefore, with what delight I see simple means coming into use to prevent such mutilation. As to Dr. Herbst, Carlyle has said, I think, that genius is an unlimited capacity for hard work. I regard that man as a genius. I regard him, too, as ingenious. I am glad to hear Dr. Rehwinkel state that he is a modest man. We who know him know that. Nevertheless it is well that it should be stated upon this floor. He acknowledges that the principles underlying his method are old, but some of our younger men do not remember that those principles were taught long ago. We are now simply coming back in the cycle of return to their practice, with Dr. Herbst as a leader. Any method which is based upon correct principles will stand, and will in time be adopted by the profession.

DR. PERRY: I do not understand why Dr. Hunt should single me out and bring me in this way before you. I confess to you that unfortunately I have not had the experience with this method that would enable me to discuss it at all. But this I will say, that if it should prove to be utterly worthless, we still are indebted largely to Dr. Herbst for several reasons. One is that he has brought to our attention a preparation of gold undoubtedly superior to anything we have had, and through that means our manufacturers will, I feel certain, be stimulated to the production of a gold which shall be equal to that made by Wolrab. I think, too, we are under obligations to him for the example he has set us of modesty and generosity. He has said, and it is known among his friends, that he came to this country with the distinct determination that if his system proved to be a failure after being subjected to our criticism, he was willing to give it up. There is no self-assertion about that. There is no selfishness about it. It is the manifestation of the true scientific spirit. It seems to me there is one point that should be borne upon with particular stress, and that is that undoubtedly, as far as I can learn, to Dr. Herbst is due the idea of rotary motion in packing gold. Whatever else comes out of it, I think that idea was original with him. Let us give him credit for that.

DR. FILLEBROWN: The discussion that has been carried on this morning would seem to imply that there was no intermediate method of filling teeth ever used, between that of Herbst and that of the mallet. I desire it to appear that there are a large number of operators in this country who ignore the mallet as thoroughly as do Dr. Herbst and his friends; that there are operators in this country who for many years were as earnest advocates of the mallet as Dr. Atkinson himself, and many of them enthusiasts. But they have left it, and have proved that much force was not necessary to produce operations that have proved creditable to them and without the use of the mallet,—not done with soft gold, not done upon the wedging process, but by the use of cohesive gold with hand-pressure. The burnishing process which has been so well explained, when applied to these fillings, produces hard surfaces that wear for years. Under this hand-pressure gold can be used in quite considerable quantities at a time as well as in an attenuated form, and can be made to resist all the forces exerted upon it in the mouth as well as though impacted by the mallet. Fillings thus made will endure as well in other respects and will resist the inroads of fluids between themselves and the walls of the cavity as well as any filling can be

expected to. I have here a copper cent, a little spot upon which was roughened up with a sharp excavator, cohesive gold was laid on that roughened surface, and a finely serrated hand plugger was used to press the gold into contact with it and to pack layer upon layer until it was raised to the elevation it has now. A burnisher was then used, and the whole force of the operator's hand was applied in burnishing the entire surface of the gold. This has been carried in my pocket for over two years, and the gold is still there, firm and strong, and the finish remains. This proves that these things can be done if you do not use the mallet, if you do not use the Herbst method, if you do not use a matrix, and if you do not use a great many other things that are thought by many to be necessary. With reference to time, I will simply say that all these operations can be performed by this method in much less time than by the use of the mallet or, as far as I have seen, by the Herbst process. This, to my mind, proves that while the knowledge of the cohesive quality of gold is widespread and appreciated, it is not thoroughly understood nor thoroughly trusted. We want to realize that to get the benefit of the cohesive quality of gold, all that is necessary is to bring the surfaces in contact with force enough to break down the angles. There is no need of hammering the life out of it. I want to express my gratification to Dr. Herbst for his process. I understand the method to be, in a few words, the application of the rotary motion to condense the gold. I do not believe any other man ever thought of it or applied it until he suggested it. I want also to express my gratification at seeing a man so thoroughly dextrous, so ingenious and original. There are many of us who will have in many respects to take a little lower seat as operators than he deserves to occupy. I am sure I have derived much benefit from what I have learned here of his method, and, as Dr. Truman has said, I am going to take my instruments home with me and try it. I am sure there is much in it that I shall be able to apply in connection with my own method of operating.

Dr. Taft: In reference to the criticism which Dr. Truman made upon my statement as to the obtundent, I simply gave the experience I have had with it and its mode of action, and also the statement of Dr. Herbst that he has used it for five years, and that no unfavorable results have occurred from its use. The experience I have had during the last month gave me, in connection with his experience, confidence in it, and I have not overstated in regard to its merits.

The reasons suggested by Prof. Truman for great caution are not

warranted by the facts. It is not so violent an agent as he would have us believe. Sulphuric acid is used and has been for years in the treatment of alveolar abscess and in various surgical operations, and if it were as violent in its action and as liable to do injury as we may infer from his remarks, it would be a totally impracticable thing for this purpose. How often has it been used in abscessed cavities and in diseases of the gums, and in various surgical operations, without destroying the healthy or living tissues beyond? It is an escharotic. It does destroy upon the surface with which it comes into immediate contact, as is shown when applied to sensitive dentine.

After cutting away the layer that has been obtunded, it is found that the dentine is sensitive beyond that point, and reäpplication is required. I do not conceive that the agent is capable of doing the mischief charged by Prof. Truman. I desire to make this statement, fearing that some might be led by his statement to refuse an agent which may be of very great service in the hands of those who will use it properly.

DR. BOGUE: Veratria has been of very great assistance to me in obtunding sensitive dentine. A certain amount—about a grain—of veratria will dissolve in about three drops of alcohol. To that put sufficient tannin to saturate it, and then add ten drops of glycerin. It will of course be understood that this remedy must be applied when the dam is in place and the teeth perfectly dry, as it is exceedingly poisonous. One-fiftieth of a grain is a dose. After being in the tooth ten minutes I wash the cavity with alcohol, dry it thoroughly, and find I am able to excavate with little pain.

DR. TRUMAN: I wish to respond briefly to Dr. Taft, as it appears to me he has shirked the whole question in his answer to my remarks. He alluded to the treatment of sensitive cavities, and I confined my remarks to that point. He is certainly as well aware of the fact as I am that the living tissue traverses the entire dentine, and that an escharotic cannot be placed in a cavity without running the risk of disturbing the main body of the pulp. The fact that sulphuric acid is and can be used in alveolar abscess is not the question at issue. The conditions are entirely dissimilar. In regard to the assertion that Dr. Herbst used it in Germany for five years without any unfavorable results proves very little. The immediate result may not have been unfavorable, but time and careful statistics can alone settle the ultimate effect. The character of the teeth is also quite different in Germany, so far as density is concerned. Here we are obliged to work principally upon teeth of soft structure,

and we cannot use as powerful an escharotic as this with the same degree of safety as Dr. Herbst may be able to do under different conditions.

DR. BÖDECKER: While in Bremen last year Dr. Herbst called my attention to this obtundent again, and I told him I should be somewhat afraid of it, and he said, "Do me the favor to go with me to several of my patients on whom I have used it." I went with him and saw a young lady, about ten years of age, with very delicate teeth that under no circumstances whatever would I have filled with gold. I said, "Why do you fill these teeth with gold?" He told me that when he applied this obtundent, he found that they would stand with gold better than with anything else he could put there. Dr. Herbst said, "I do not myself know why." The edges of these cavities were absolutely perfect. The teeth were of a very delicate character. I saw three cases in which he claimed he had used the obtundent, and in none of them did I see any bad results. In one of them Dr. Herbst claims that the pulp had been exposed, and he had used the obtundent and capped the pulp, which was found to be alive. The sensibility under the operation is usually very little. I do not think there is such great danger as Dr. Truman speaks of. In fact, I have had it applied to four teeth in my own mouth, and I hope to show you next year what effect the obtundent has had on my teeth.

DR. MORGAN: In the use of obtundents we should understand exactly what we are doing. I am not chemist enough to know whether a new compound is formed in making this preparation or what its character would be if formed. We do know that in using alkaline caustics for the purpose of obtunding, they only act to a certain extent, and so we use them from the stand-point of some knowledge. It is not empirical. I do not care how poisonous a material is, if it is self-limiting and does not go beyond a certain defined point, you can by experiment determine how much can be used and use it within the line of safety; but when you use an obtundent the nature of which is not understood, you are liable to do harm. We know that a certain amount of aqua ammonia will destroy a limited portion of the living tissue with which it comes in contact. It is an excellent obtundent and its action is so superficial that we can use it frequently with safety. We know that arsenic is an obtundent, but when you put it into a tooth you don't know when its action is going to cease. It may seem to act beautifully at first, but its action may run on for months, and even years, doing mischief all the while.

When you talk to me about an obtundent, I want to know what it is, and I want to know how it acts upon living tissue, whether it satisfies itself by a chemical union with the living parts, or whether it lies there as poison which can be taken up and carried on and be cumulative in its action.

DR. BROPHY: Since I have been in the practice of dentistry there have been introduced from time to time various substances for the purpose of obtunding sensitive dentine, and from year to year these substances have been abandoned. For what purpose? Simply because they permanently injured the tooth-structure. It has been proved that any escharotic which is capable of obtunding sensitive dentine does so at the risk of impairing the vitality of the pulp. We have had something introduced to-day. I want to know what its action upon the tissues is; whether it is applied as an anesthetic, or whether it destroys the parts, and unless its advocates are prepared to say what it does, I for one object to making use of it. Let experiments be made so as to demonstrate exactly the effects of this agent, and then we will accept it, provided it does no harm to the tissues. There is not a gentleman here of any experience who has not seen pulps devitalized by the action of obtundents that have been invented and introduced to us for the purpose of rendering dental operations less painful. The idea of obtunding sensitive dentine is by no means new. The agent mentioned, however, may possess great merit.

DR. SITHERWOOD: I want to make a single remark in reference to this obtundent. As I understand, the principal agent is sulphuric acid. It cannot possibly do any harm to the teeth in so small a quantity.

DR. TAFT: I have stated that this obtundent consists of sulphuric acid, cocaïne, and sulphuric ether. I tried to state the nature of its action. Sulphuric acid being an escharotic and acting upon the calcareous portions of the tooth dissolves it upon the surface, and sulphate of lime is formed. That is insoluble in water or saliva. It is apparent in the cavity in a minute amount, simply lining the cavity. The cocaïne is used as an obtundent to prevent the pain that may occur by the action of the acid. The sulphuric acid acts as an escharotic on the exposed organic portion of the tooth; beyond that it does not reach nor affect. There is no more danger of its affecting the pulp of the tooth than of destroying the eye.

DR. TRUMAN: What becomes of the fibrils; are they affected or not?

DR. TAFT: Only so far as there is contact between the agent and the fibrils. There its action ceases and it cannot go beyond that point. It is not capable of being taken up and carried on. Its action is prompt, and it cannot be absorbed by the tissue, and it has no after-action whatever.

DR. SITHERWOOD: Prof. Taft has made my speech. I only want to emphasize it. Sulphuric acid in so small a quantity and in that combination cannot possibly do harm to the teeth. Its value and use in surgery are well understood, especially as a local application in bone caries.

DR. TRUMAN: That is no evidence.

DR. H. A. SMITH: Escharotics have been spoken of as agents for obtunding sensitive dentine. We all know that chloride of zinc was formerly used quite extensively for this purpose; especially was it recommended by Prof. Watt. The combination of cocaïne with sulphuric acid suggests that cocaïne might be useful in combination with chloride of zinc to prevent or mitigate the pain which the chloride causes when placed upon living dentine. Its action is said to be self-limiting,—that is, when the affinities between the chloride of zinc and the dentine are satisfied it ceases to act. The severe irritant effect of the escharotic, however, may create a grade of inflammation in the pulp, when applied in deep-seated cavities, that will ultimately cause its death. If it is found that in combination with cocaïne the pain and dangers attending the application of chloride of zinc to sensitive dentine may be avoided, we see no reason why this obtundent may not come into more frequent use than at present.

DR. ATKINSON: I wish to state that it is desirable when we are speaking of any agent, if we do not know positively how it behaves upon the tissues, for us not to assume that we do. No one, so far as I know, has assumed that he understood exactly what sort of a combination this obtundent introduced by Dr. Herbst is. Even chemists themselves have tried in vain to determine whether it was a mixture of the molecules of the substances united in the preparation, or whether there was a new bond formed by it, and until we know that we are at loose ends, and dealing with this as we have done with almost all our remedies—that is, empirically. I do not see why we need be scared out of our boots by the old fogies who assume to know what they do not know, saying "beware," and prophesying the mischief that is going to come. There was one remark made by the last speaker, that chlorine was self-limiting. Chlo-

ride of zinc, of all the agents I know, is the one that is not self-limiting. When it is supposed to have set the pulp entirely at ease to perform its function, it has set it at ease by reducing it to a hydrochloride of albumen, rendering it as clear as glass, so that it would leave the tooth without being changed; so that we had better be careful about that. What have we to learn and how much can we state that has been learned with regard to this question? To the younger men especially I want to say that anything that is self-limiting is self-limiting by reason of excess making a new solution of the albuminoid portion of the tissues that is in itself soluble in the agent. We have many examples of the salts that do that. Chloride of zinc is not one of these salts. Arsenic is not one of these salts, and we do not know where the mischief will end. Nitric acid is an example of self-limitation. That it makes a combination of some kind we know. Nitrate of silver is the same. But I wish particularly to defend the man who cannot speak English. He has been modest and he has been generous. He has been keen-sighted and he has been noble-hearted in all that he has done, and I love him and I admire him, and I wish I could speak German and tell him so. I admire him as a representative of the truth. I praise no man. I praise the individual as the representative of the world of light and intelligence that gives us all we have. There are men whom I love who say I hate them and abuse them when I am talking. They never committed a worse blunder. I do not fight. I do not quarrel. I do not contend. I merely emulate, and I love the man who loves the truth and is the elaborator and reflector of the truth. That is the point, and that is why I admire and love the man as I do, as the representative of that which we all claim as ours, not mine nor thine. It belongs to us, and if we put ourselves in the right line of the inspiration of revealing the truth to all men and be solid enough to wait until the testimony has been presented to us sufficient to convince our own minds, we won't get mad at each other any more. We won't say, "When I have the chance I will squeeze you; I will fetch you to time," and say I am going to be a gentleman at the same time, and then take the most outrageous advantage by the assertion of power. I am little enough or big enough not to care. You can say I am above or below criticism. I love the truth and I love you as the representatives of the truth, as I love no other body upon the planet. There is no such body upon this planet, I don't care where you go. There is no such concatenation of earnest seekers after truth as represented in this noble man from Germany as is to be found among

dentists, for they are the embodiment of the light and truth that has been brought to this planet by love and wisdom.

DR. MARSHALL: Dr. Fernandez, of Chicago, placed in my hands a little instrument which he desired me to present to the chairman of the Section on Operative Dentistry for exhibition to the Association. It is simply a little tool for dressing corundum wheels and points. It is made from a black diamond set in a piece of soft steel, a hole being drilled in the end of the steel; the largest end of the diamond is placed in it, and the steel then closed down upon it by hammering upon an anvil. With this you can shape and dress corundum wheels or points as you would turn down a piece of wood in a lathe. I consider it a valuable little instrument, and hope Dr. Fernandez will take steps to have them placed upon the market for the benefit of the profession.

DR. BROPHY: I did not intend to speak at this time upon the subject of the matrix which I devised, but I have been requested to describe it, and I certainly have no hesitation in doing so. There are some here who may not have seen it, and who do not know of the merits which I claim for it. The matrix which requires a wedge for its retention is objectionable for the reason that the introduction of the wedge not only injures the gum-tissue against which it is placed, but it also drives the matrix close to the cervical border of the tooth as well as to the approximal cavity, thereby preventing the adjustment of gold around its edges. In order to overcome this, I began experimenting to determine the adaptability of thin bands of steel. My experiments resulted in producing a band that may be adapted closely to the neck of the tooth, and yet be sufficiently thin and yielding to enable the operator to carry the gold around the borders of the cavity and secure as perfect adaptation as it is possible to obtain by any means. I think, indeed, by using wedge-shaped pluggers and carrying the gold between the tooth-wall and the thin band, it may be more thoroughly and perfectly condensed than it is likely to be when the matrix is not used. Those who have tried it know what can be done with it, and those who have not will find that they can accomplish all that I claim, provided they will bear in mind that it is essential to introduce the first piece of gold between the band and the tooth so as to make a perfect border. Our friend, Dr. Herbst, had the idea in mind, and he has exhibited to us a band matrix, but it is open to this objection. It is made so as to be passed over the crown of the tooth, and is not provided with any device by which it may be adapted to the neck. The

crown being broad and the neck constricted, it will necessarily stand away from the cervical wall. He brings it into position by the introduction of a wedge, but the use of the wedge is objectionable. The matrix enables us, and, in fact, I may say almost forces us, to secure a better fitting of the gold to the margins than we otherwise would probably obtain, because by its use the metal is condensed directly toward the root of the tooth, as I will show by a diagram upon the board. There is another advantage. If we have a cavity upon both approximal surfaces and running over into the masticating surface, the operation is the same upon one as upon the other side. We fill both sides, and finish the operation at the same time. Moreover, a band matrix may be adjusted to a tooth on either side of which there is no other tooth in contact, and this is a great advantage. In the old-fashioned way, under this condition, it was impossible to introduce a matrix except with a complicated apparatus, such as was described by Dr. Jack, of Philadelphia. Dr. Herbst has something new. He has used shellac in some cases where a great space existed, and thereby secured about the same result that we have here. The thin band is adjustable between the teeth. I have yet to see a case where it was impossible, or where it was indeed difficult to pass it between the teeth. As I have said, it may be introduced where floss silk cannot be used, because in some cases minute cavities are present between teeth whose edges cut the floss silk, and which prevent its passage gumward. This band being stronger than floss silk will readily pass over the edges of a cavity to the point desired, and is securely held in position by tightening the screw. I would like to say to those who have not used my matrix, and who expect to do so, that when it is applied to the inferior teeth the screw should be placed on the lingual surface, and when to the superior teeth, its position should be upon the buccal surface. The reason being that the lingual wall of the lower teeth is more straight and the screw will not slip, while the buccal surface is slightly convex, a condition which renders the screw more liable to get out of place. The buccal walls of the upper molars and bicuspids are, as a rule, more straight than the palatal walls.

DR. MCKELLOPS: Dr. Perry has a very ingenious contrivance here. He is a very modest man. I would like to have him describe it.

DR. PERRY: I am sorry to be called out in this matter. Somewhat recently I devised a hand-piece attachment, as it may be called, by which it seems to me it is possible to combine the advantages of the Suspension and the Bonwill engines. Several of my friends seeing

it in a partially completed state said to me that they would like to have one for themselves. That, as a matter of course, brought up the question of manufacture, and to bring up the question of manufacture was to bring up the question of a patent. The separators which bear my name have not been patented. No attempt has ever been made to patent them. It was not necessary, because I found that The S. S. White Company were willing to manufacture them in such a manner that I could be satisfied with them, and so that the profession could have them; therefore a patent was not necessary. The question of the manufacture of this attachment, however, seemed to bring about a different state of things. To find some one who would manufacture it necessitated a patent, and the patent was applied for and secured. I was told to-day by Dr. Bonwill that it was not the habit of this society to have described before it articles which had been patented. He said he had been prevented before now from exhibiting devices of his, and he thought the same rule would obtain with me. I assure you that if I had for a moment supposed that was the habit of this society or that there could be any objection to my bringing an article of that sort here, the device would not have been spoken of, or would not have gone before the Section. I shall only be too glad to let it drop where it is and not exhibit it.

The PRESIDENT: The matter is a part of the report of the Section, and as such can properly come before this body.

DR. PERRY: I dislike to make a new precedent for this society.

The PRESIDENT: There is no breach of custom. It is a matter that is reported from the Section. We received it from the Section, and it is properly a part of their report.

DR. PERRY: For a long time I have believed that to get the best results from a dental engine the cord must be run directly over a pulley attached to the spindle of the hand-piece. Only in this way, so far as I know, can a steady, lathe-like motion, free from "back-lash" and noise, be obtained. Undoubtedly this steadiness of motion makes the engine more bearable to the patient, as well as more satisfactory to the operator. For this reason I formerly used the Suspension engine, but for several years I have adopted the Bonwill, attaching to it at different times the Bonwill and Hodge hand-pieces. I have considered the Bonwill engine a great step in advance of the Suspension, mainly because different tensions can be given to the cord, because the weight is taken off the hand by the spiral spring which supports the arm, and because of its great freedom of movement.

But I have never been satisfied with Dr. Bonwill's method of attaching the hand-piece to the arm. Although it has advantages, it has some disadvantages which to me have been so great that I have been led to attempt to overcome them. I have therefore devised an attachment by which I am able to combine the advantages of the Elliott Suspension and the Bonwill engines. The hand-piece, as you see, is the Hodge (which ought, however, to be called the Weber hand-piece, as it is the result, I believe, of Mr. August Weber's ingenuity), and the means of attaching it to the arm of the Bonwill engine suggests the manner in which the cord runs over the spindle of the Elliott Suspension. There are four small pulleys attached to a block, which swivels around the end of the hand-piece in such a way as to hold the cord in unvarying relation to the pulley attached to the spindle.

This block is hinged to the arm of the engine and also made to swivel around it. As only two of the four pulleys run at any one time, the friction is not increased, and in changing from one position to another the cord is crossed between the pulleys and what may be called the elbow-joint of the arm, instead of between the pulleys and the wrist-joint as in the Bonwill. This avoids the disagreeable crossing of the cords in such a short space that they often jump off the pulleys and twist. If the pulleys are set a little further away from the hand-piece, as Dr. Bonwill prefers to have them, evidently to avoid this danger, then there is a greater drag on that side of the hand-piece, and a feeling of awkwardness which I have never been able to become accustomed to.

By attaching the hand-piece—and either one can be used—as is here shown, this awkwardness is almost entirely overcome, because in most positions the block swivels in such a way as to allow the cord to pass from the arm directly around the spindle pulley. By adopting a braided fishing-line (a suggestion of Dr. Register's), the ends of which I put together without splicing, and sew with fine silk, I get rid of the bunch which is made by using corset cord united by putting one end into the other, and I can therefore place the small pulleys close to the main pulley without danger of feeling the "jump" made by the bunch on the corset cord passing over three pulleys so near together. The fishing-line is firm in texture, and by using rubber bands on the engine wheel and on the spindle pulley, as advised by Dr. Wardwell, the line can be run with loose tension without slipping. By making separate bearings for the pulley spindle, which is done without increasing the friction perceptibly, the hand-piece

can be detached by unscrewing, and the right-angle attachment secured directly to the pulley block. This gives great steadiness of motion to the right-angle attachment and adds very greatly to the efficiency of that instrument. I have cone-journals in the pulley block with a set-screw for taking up wear, and all the parts can be easily taken apart to be cleaned and oiled. This makes a device which will practically never wear out. I have also designed a shield to protect the hand from the main pulley, as well as to shield the hand from a careless application of oil to the small pulleys.

The small pulleys have no side bearings, but run free on the pins, being always kept in place by the cord as it passes over the spindle pulley. This absence of friction adds to the free, light feeling of the hand-piece, when operated in different positions.

There is absolute freedom of movement of the hand-piece, except when it is held in one position. When the hand-piece and the arm are held nearly in a line with each other, the pulley block does not readily swivel. This is easily overcome by raising or lowering the extension arm, and what might at first seem to be a fault proves to be even an advantage, because this change of position in either direction brings the cord over the pulley at nearly right angles to the spindle, and therefore lessens the friction of the side rollers. In fact, after a little study of this attachment, I think it will be seen that while there is no possible position that cannot readily be reached by it, it will also be found that in most of the work on the teeth the cord actually runs over the spindle at nearly right angles. It need not be said that this relation of the cord to the spindle is the secret of its remarkable lightness, as well as steadiness of feeling in the hand.

Dr. Watkins: I have here a few double-end hand instruments. They were devised for the purpose of finishing amalgam fillings on approximal surfaces. I have no doubt that most of you in looking over amalgam fillings which have been put in by others have noticed that they project beyond the cervical walls, sometimes a considerable distance. I think in the majority of cases I might say they project. Seeing so many of those fillings has caused me to make these instruments. I will pass them so that you can see them. They are very thin, and with different curves so that they will fit around the necks of teeth from any position. It seems to me that with these instruments it is just as easy to trim the approximal surface of a filling wherever it projects beyond the gum of the anterior or posterior part of the second or third molar as it is on the approxi.

mal surface of a bicuspid or any other tooth. You will see each instrument is so curved that drawing it in one way it will cut, and the other it will scrape. If they catch on the edge of the filling they will spring off. I will also show a brush which I devised, the principal advantage of which is the curve from one end to the other, the brush being very narrow at the end so that it takes but little room in the mouth, and having a projection at the end. The idea is to enable one to clean around the posterior part of the wisdom-teeth and the lingual surfaces of all the teeth with as much ease as on the labial surfaces of the front teeth.

DR. GUILFORD: The committee were kind enough to allude to a little device that I contrived within the past year. I can explain it better with the aid of the blackboard than otherwise. I have been a believer in matrices, and a user of them for many years. In those that had already been devised, there were none that could be used for a compound cavity in the posterior surface of the last teeth in the mouth or of a tooth standing alone, except a loop matrix entirely encircling the tooth.

Where the teeth anterior to the one to be filled were closely approximated, it was always difficult and sometimes well-nigh impossible to force the steel loop between these teeth.

My object was to devise a flexible band matrix, encircling the greater portion of the circumference of the tooth to be operated upon, yet occupying but one interdental space, and firmly held in position by a small and rigid clamp, which should not obstruct the view of the cavity nor be in the way of the operator. Incidentally with this, it was considered desirable to have it consist of as few parts as possible, be direct in its action, and simple and inexpensive in its construction. My device consists essentially of but two parts, —a flexible steel band, and a small steel clamp for adjusting the band and holding it firmly in position. The general form of the band is shown in Fig. 1. It is cut from sheet steel, five one-thousandths of an inch in thickness, and is made long enough to pass a little beyond the most prominent portions of the tooth on both the buccal and palatal surfaces. Its upper edge is either curved or straight, while the lower edge dips down at some point to cover the deep-lying border of the cavity. The width of the band, except at the deep portion, should nearly equal the height of the crown minus the cusps. The ends are rounded, and near the extremities a small hole is punched for engaging with the toe and screw of the clamp. A number of sizes are needed, varying slightly in width, but mostly

in length, to accommodate them to the different sizes of bicuspids and molars.

Fig. 2 represents the clamp. It is cut from steel about three sixty-fourths of an inch in thickness, and from the main portion or back there extend two short arms at right angles. One of these arms terminates in a conical point or toe pointing inward, while the other arm is flattened, drilled, and tapped to receive the screw. The inner edge of the back should be chamfered on both sides, so as to allow it to set well down and out of the way in the groove between the cusps of adjoining teeth. If there be no adjoining tooth the clamp, after being adjusted, can be swung over and occupy the interdental space.

Preparatory to using, the ends of the band should be bent at a slight angle to the main portion, in the region of the perforations, so as to admit of their being drawn into the angle between the teeth without interference from the adjoining tooth.

FIG. 1.

FIG. 2.

FIG. 3.

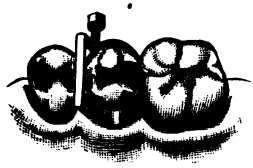
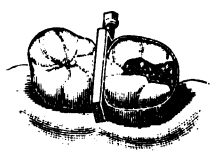


FIG. 4.



In applying, the band should be bent in the form of a bow, and the holes caught over the points of the toe and screw of the clamp, care being taken to see that the clamp when in position shall have the screw on the buccal surface. With the two thus united, the band is slipped over the tooth and pressed into place, the clamp dropping into the depression between the teeth. The screw is then turned by means of a watch-key, or some equivalent appliance, until the band is drawn as tightly as need be around the tooth and firmly held there.

It will be readily understood that whenever the screw is turned the tension at the toe of the clamp will be as great as that at the point of the screw, thus obviating the use of two screws and obtaining the same result. In my earlier patterns the clamp was made larger and curved so that the bow might be thrown further away from the points of engagement with the band, but it was discarded in favor of the present one, on account of its lack of rigidity, unless made too heavy for convenience.

Figs. 3 and 4 show the matrix in position on a bicuspid and molar

respectively. Three sizes of the clamp are needed; one for use with bicuspids, another to lie between molars and bicuspids, and the third for use in connection with the molars alone.

The shallowness of the clamp, in connection with its resting upon the crowns of the teeth, effectually prevents the band from slipping up into the gum. Should the dipping portion of the band not lie quite close to the neck of the tooth, it may be brought up and held there by a small orange-wood wedge if there be a tooth posterior to it.

It may be said of this as of other matrices that, while they may be used in connection with a cavity involving only the mesial and crown surfaces of a tooth, they are all of most service in the filling of distal compound cavities.

When a matrix is used in the filling of a mesial compound cavity it necessarily excludes the light, limits the room of the operator, and casts a shadow; while, used on the distal surface, it illuminates the cavity by reflection and is entirely out of the way. While the band matrix is intended principally for use in connection with compound cavities, it may also be made serviceable, with a slight modification, in the filling of a very difficult class of simple approximal cavities.

Every practitioner, at times, meets with small simple cavities situated midway or near the neck on the approximal surfaces of the bicuspids and molars. Where the arch is not crowded or the teeth not too firmly set, there is usually no difficulty in wedging the teeth apart sufficiently to fill these cavities satisfactorily, but where there is no time to separate, or where the cavities are situated so near the cervical border that separation even would not greatly simplify the filling of them, we have but two alternatives to choose from in the matter of obtaining space. Either we must cut down from the crown, converting the simple cavity into a compound one, or we must continue the simple cavity out to the buccal surface, and fill from that direction. The first plan, although practiced by some operators, involves the cutting away of too much good tooth-structure to make it either commendable or desirable. The second plan, decidedly the better one, gives us an oblong, shallow cavity, requiring the utmost care and skill to fill properly.

To assist in the filling of such cavities I have modified the band shown in Fig. 1, by slotting it in the direction of its length at a point opposite the buccal opening of the cavity. The slotting of the band gives us an ear, which in use is bent outward to lie over the bucco-

approximal angle of the adjoining tooth. This band, placed in position and held firmly by the clamp already described, forms in connection with the cavity an oblong pocket that is readily and quickly filled. The band, separately and in position, is shown in Fig. 5.

For the filling of a double compound cavity—one involving distal, mesial, and masticating surfaces—a band will be required having a dip near each end, as shown in Fig. 6, and the clamp will then have to be placed entirely on the buccal surface.

A more suitable and convenient clamp for use on the buccal sur-

FIG. 5.

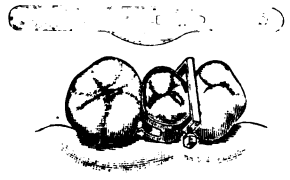
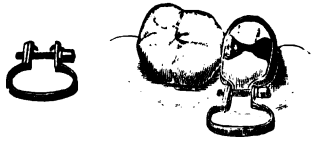


FIG. 6.

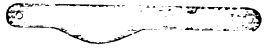
FIG. 7.



face is shown separately and in position in Fig. 7. The bow portion, which is small, is made thin, so as to be elastic, while the projecting arms are heavy. These arms have a foot-shaped pin inserted on their inner sides, facing each other. Between these pins and the bow portion each arm is perforated to accommodate the screw. The hole in one arm is tapped to receive the thread of the screw, while the hole in the other is made oblong to afford play for the screw in its action. The screw itself is similar in shape to the one used in the clamp previously described. The ends of the band to be used in connection with this clamp should be perforated by means of a pin-punch near their extremities. In use, these holes are slipped over the foot-shaped projections on the clamp, and the band, after being placed in position on the tooth, is made tight by means of the screw.

The same clamp and band can also be used, when desired, for the filling of a single compound cavity where natural space exists for its introduction in the first interdental space anterior to the cavity. The band to be used in this way should be shaped as shown in Fig. 8, with the dip near one end of the band.

FIG. 8.



SECTION V.

ANATOMY, HISTOLOGY, AND MICROSCOPY.

REPORT BY FRANK ABBOTT, CHAIRMAN.

During the year very little of importance in the microscopical world seems to have been accomplished, in the line of study particularly interesting to the members of this Association, which has been made public. Work of very great importance, however, is being pushed forward, and in due time will be published.

The only paper or work of especial interest to this Association, in the mind of your Section, is an illustrated article in the *Independent Practitioner*, No. 3, 1886, by Drs. Heitzmann and Bödecker, entitled "Eburnitis" (inflammation of dentine). It will be remembered that in 1879 I published the result of my investigations of caries of human teeth, in which article I described and illustrated the process as being carried on in a great measure by inflammation. This theory, as you all know, was opposed by some, on the ground that there is not vitality or living tissue enough in the dentine of teeth to admit of the presence of the process of inflammation, even under the extremely irritating and destructive process of caries. I thought seven years ago that I had pretty clearly established the fact that there was, and have never had occasion to change my views since. In fact, the more I study specimens of carious teeth the more I am convinced that my original position was correct. This article ("Eburnitis"), by Heitzmann and Bödecker, clearly establishes the fact that dentine is subject to inflammation, not only during severe carious destruction, but when only slight caries exists, and in rare cases where really no caries at all is present. Nothing of importance either in Anatomy or Histology, pure and simple, has come to the notice of the Section. Unfortunately, Mr. President, Section V finds itself before the Association again with only one paper, although unusual efforts have been made to make a better showing.

SECTION V.—Continued.

Hyperostosis of Roots of Teeth.

PAPER BY FRANK ABBOTT, OF THE SECTION.

UNDER the term "hyperostosis" I propose to consider all the forms of pathological new growths of cementum, including what authors are wont to term osteoma, exostosis, hypertrophy of the cement, etc.

As to the causes of this not very infrequent disease, the following points may be enumerated:

A. Direct irritation of the pericementum through slight long-standing caries of the crown or neck; or, exposure of the pulp, mainly the result of caries.

B. Localized irritation of the pericementum of constitutional origin, such as from gout and syphilis.

C. Irritation of the pericementum of upper teeth after the removal of their antagonizing teeth of the lower jaw, the result of or induced by gravitation.

Obviously, irritation of the pericementum is considered by all authors as the cause of outgrowths of cementum.

All tumors are considered as the result of a chronic irritation of the mother tissue; not sufficiently intense to produce symptoms of inflammation, with its typical termination into hypertrophy, or, should suppuration have preceded, into cicatrization. Tumors are unlimited growths, caused probably by a constant local irritation, first of the mother tissue, and later on of the already formed tumor itself. Recently the theory of the late Cohnheim has attracted no little attention, viz., that "all tumors are the result of a misplacement of embryonal germs." Unquestionably such a misplacement may occur, but in many instances they either are not traceable, or embryonal tissues may be found misplaced in normal tissues, without ever having given rise to the formation of a tumor. That a

chronic irritation of the pericementum, whatever the cause may be, may result in a new formation of cementum, nobody will doubt; nay, it has been clearly proved by Bödecker that a circumscribed hyperostosis of the cementum may arise from chronic pericementitis. The question, however, is, can a diffused enlargement of the cementum occur in consequence of pericementitis, either of a local or constitutional origin, after the cementum has once been fully formed? This question I feel constrained to answer in the negative, and I base my opinions upon microscopical studies of such tumors. My conviction is that hyperostosis of cementum of a diffused character is *in most instances a fetal malformation.*

If a carious tooth be extracted, and the roots be found in a hyperplastic condition, the first impression, of course, would be that the inflamed pulp in this case has led to pericementitis, and the latter to hyperostosis of the roots. This undoubtedly in some instances may be the case, more especially when the process of caries has attacked a lateral surface of the crown or the neck of a molar, and the root or roots nearest to the point of irritation of the pulp are found to be enlarged; but if all the roots of a molar are uniformly enlarged, or fused together, we hardly feel justified in stating that caries was the primary and hyperostosis of the roots the secondary cause, or the result of such a primary cause; for it is possible that the hyperplasia of the roots had been present long before the caries made its appearance. The latter assumption becomes almost a certainty when, upon grinding such teeth for microscopical research, we find either that the caries has not penetrated sufficiently deep to cause inflammation of the pulp, or the dentine is found in a condition which could not be the result of simple "eburnitis," but can have been the result only of a malformation at the beginning of its growth in fetal life.

After a careful study of a large number of specimens of hyperostosis, I feel entitled to make the statement that such teeth were sound and their pulps alive at the time when the bony growth had formed. I would therefore question the statement of Dr. Barrett, in his paper entitled "Exostosis," recently read before the Connecticut Valley Dental Society.

Whenever a tooth becomes deprived of its nourishment from the pulp, I doubt the possibility of an osseous new formation upon the cementum; and, further, should such a new formation have existed previously, its growth has undoubtedly ceased the moment the life of the pulp was gone. Should a dentist extract a sound-looking

tooth to relieve excessive pericementitis, or neuralgia suspected to arise from pericementitis, and find the root or roots considerably enlarged, he would hardly be justified in concluding that the pericementitis and neuralgia had caused the growth upon the roots; but, on the contrary, he would naturally conclude that the growth had been the primary and the pericementitis and neuralgia the secondary features of the disease. If a large number of sound-looking teeth be removed from the same person's upper jaw, for instance, to relieve neuralgia, the roots of all of which are found to be considerably enlarged, we conclude that these roots were malformed at the earliest stage of their development. I have in my possession six upper molars, all removed from the same person's mouth, to relieve neuralgia, the roots of all of which are more or less enlarged; three of them have no decay whatever in their crowns, and the other three are but slightly affected. At the time of birth only the crowns of the temporary teeth are found to have been formed, and nothing is known as to the exact period of beginning of the formation of cementum upon the roots; probably it is during the first year of extra-uterine life, the process beginning upon the permanent teeth several years later.

Cementum being identical in its construction with bone-tissue, we are safe in concluding that their development is likewise identical. Bone, the same as any other tissue, originates or is built from medullary or embryonic tissue. It makes no difference whether cartilage is formed first, as in the lower jaw-bone, or fibrous connective-tissue, as in the flat skull bones; the changes in order to produce bone are the same—each is first converted into medullary or embryonic tissue, from which the bone proper is formed. Some of the older authors (Tomes, Shelly, and others) adhere to the theory that medullary corpuscles (osteal cells) "secrete or accumulate about them an outer investment of basis-substance, and afterward, being hollowed out, form the lacunæ, while the canaliculi are made on the plan of pore-canals of plants." To-day we know that the lacunæ contain living protoplasm, the so-called bone-corpuscles, and the canaliculi hold for tenants delicate offshoots of the bone-corpuscles,—*i. e.*, fibers of living-matter. To-day we also know that the basis-substance arises from medullary corpuscles, the same as the bone-corpuscles themselves. The theory of secretion of intercellular substance is a theory of the past. All good and reliable observers agree that only one portion of the protoplasm is transformed into basis-substance, viz: the lifeless liquid, which changes into a solid glue-yielding mass, which forms the matrix and is the seat of infiltration of lime-salts,

the living protoplasm remaining unaltered in the bone-corpuscles, and its *living* portion of their offshoots is preserved in the basis-substance within the canaliculi. No growth of any tissue is possible without its being first partially reduced to medullary elements. An augmentation of the cementum is impossible without a preceding augmentation of the medullary tissue, which again is caused by increased nutrition, or, as it is generally expressed, an irritation. Bödecker has demonstrated that in normal cement the lacunæ contain protoplasm, a portion of which is living-matter, and that the whole basis-substance is traversed by a delicate reticulum,—far more delicate, indeed, than previous observers have thought to exist in canaliculi. This reticulum contains the threads of living-matter in a cobweb arrangement. Thus, it was proved that the cementum is not an inert mass, a deposition of lime-salts, with hollow lacunæ and canaliculi.

I propose to show that cementum, in a pathological (hyperplastic) condition, is endowed with properties of life the same as in normal cementum. Thus it becomes explicable that hyperplastic cementum itself may become the subject of pathological processes, particularly of inflammation. Hyperplastic cementum may and often does become partially destroyed by cementitis and transformed into medullary tissue, from which, evidently, an additional new growth of cementum may start.

It is only the knowledge that cementum is a living tissue *all through* that enables us to understand the process of its development, its growth, its enlargement, its destruction, and its re-formation.

Since the beginning of the present century a good many reliable observers have described and depicted anomalous teeth with hyperostosis in varying degrees of development. Some of these illustrations are striking examples of the excessive growths to which cementum may attain, and still be tolerated by the sufferer. All observers and clinicians, I think, generally agree that this disease attacks bicuspids and molars only, incisors and cuspids appearing to be exempt; and, again, the teeth of the upper jaw are more frequently affected than those of the lower.

Facial neuralgia of the most severe and unyielding character is frequently caused by these malformations. At the same time the symptoms which point to a diagnosis of hyperostosis of the roots are not very marked. When observable at all, however, they consist of a slight continued uneasiness in the jaw (as sometimes expressed by a patient, "I can't call it real pain, but I am *constantly* aware that I

have a tooth in that locality"). It is akin to pain, with slight soreness of the tooth or teeth upon biting, while excessive pressure upon it in any direction is productive of quite severe and prolonged pain. Eventually the soreness becomes more marked, and the pain constant or intermittent, and finally terminates in possibly an abscess, severe mental derangement, or the removal of the tooth as a cure.

It is not infrequently the case that a patient suffering from neuralgia applies to a dentist to have a certain tooth extracted for relief, the case being to the dentist so obscure that he takes the patient's word for it, and takes the tooth out; but to his disgust the patient, after a few moments, turns to him and says, "Why, doctor, that isn't the tooth; the pain is just as bad as it was before you took it out." This operation is repeated over and over again with the same result, until finally, perhaps, it is the last tooth in the jaw which when taken out reveals the cause of this long suffering, in an enlarged root or roots from hyperostosis. A peculiar feature in these cases is the long-continued and most distressing pain that follows such extractions, relief coming but very slowly.

As custodian of that portion of the museum of the New York College of Dentistry which pertains to my department, I have come into possession of seventy-odd teeth exhibiting hyperostosis of the roots, and this comparatively large number prompts me to try to classify the different varieties as they occur to me. I will here add that about one-third of these teeth are sound or very nearly so. Previous authors have simply described different forms, more or less striking, without observing any system in the arrangement.

I. Circumscribed Hyperostosis.

Under this title is included osteoma and exostosis of the authors, which are characterized by an outgrowth of bone-tissue from the cementum, of a limited size, varying from that recognizable with the microscope only to that of a lentil or a pea. Their surfaces usually present a nodular appearance, and sometimes they are adjacent to newly-formed cancellous structure of bone, evidently caused by osteitis of the socket. I would subdivide this group into:

A. Osteoma on the body of the root (Fig. 1, *a*, *b*).

B. Osteoma on the apex of the root (Fig. 2, *a*, *b*).

Either of these appears mostly upon teeth the crowns of which are more or less destroyed by caries, with probably a long-standing exposed pulp, which plainly indicates that their cause is likely to be accounted for in localized pericementitis from this source. If, how-

ever, we bear in mind that the destruction of the life of the pulp prevents or stops the formation of osteoma on the roots, we must come to the conclusion that such tumors had commenced their formation long before the exposure of the pulp, or it must have remained alive for a very long time after its exposure before it died, causing during this long time a slight but constant irritation of this tissue, transferred to the pericementum.

As soon as severe pericementitis sets in from an exposed pulp, unless vigorous steps for its relief are taken, the pulp is in a fair way to become lifeless very soon. After its death severe pericementitis and its distressing terminations are too well known to practitioners to need mentioning here. In neither of the latter instances would we expect a bony outgrowth on the roots. It is only an irritation of

FIG. 1.

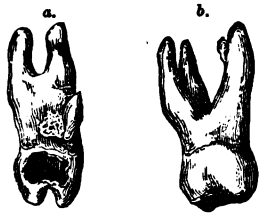
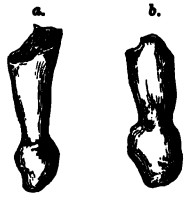


FIG. 2.



the pericementum while the pulp is living that, in my judgment, can result in an *increased* cementum.

In some persons, or conditions of persons, a very superficial decay, more particularly upon the necks of teeth, will produce marked pericementitis and neuralgia. We may infer from this fact that in other persons or conditions (or possibly the same), perhaps under the influence of constitutional disturbances, a local irritation of the pericementum is induced, causing exostosis, long before exposure of the pulp had occurred.

II. DIFFUSED HYPEROSTOSIS WITH ROOTS SEPARATED.
(Fig. 3, *a*, *b*, *c*.)

Under this heading a large number of specimens of my collection can be summed up, either of otherwise sound teeth or those decayed or filled. From what I have stated before, I will admit that pericementitis from caries is a cause of hyperostosis only when one root or two be involved, and others in a normal condition, and the enlarged root or roots corresponding to the carious cavity either on the neck or crown of the tooth. When all the roots of molars

are affected, without the least symptom of disease upon the exposed portion of the tooth in the mouth, I can see no other correct course but to seek for the cause of malformation in the beginning of the formation of cementum, to wit, during the first year of extra-uterine life. Hyperostosis of this kind invades the roots from the apex to the middle, to two-thirds their length, sometimes even to their necks. The enlargement is either blending with the crown, without a distinct boundary line, or there is a more or less marked bulging of the augmented tissue. The enlarged portion is either in a more or less horizontal line or is fluted, with here and there irregular prolongations towards the crown. In one instance I have seen a small enamel nodule corresponding exactly to the summit of a marked conical prolongation of the cementum. Sometimes the

FIG. 3.

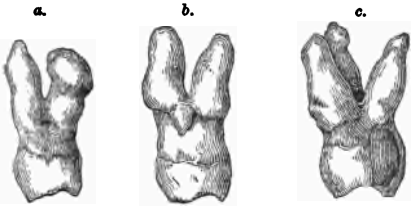
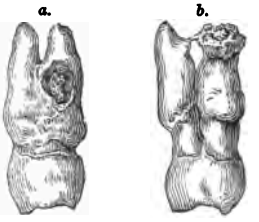


FIG. 4.



bulging of the cementum reaches the crown, and may be distinctly seen overlapping the enamel. Such formations are usually either smooth or slightly nodulated. Sometimes they are corroded as if by inflammation; and, again, upon a comparatively smooth mass there may be found bulging forth an irregular nodule of circumscribed osteoma, evidently the result of an excessive formative pericementitis.

In one of my specimens, a left upper second molar, there is upon the anterior surface of the buccal root a pit two and a half millimeters in diameter and one millimeter in depth, the base of the pit being finely corroded and nodular. On the same surface numerous small nodules are scattered about. On the neck the hyperplastic cementum is one millimeter in thickness, and terminates all around it in a nearly abrupt line. (Fig. 4, *a*.)

On a right upper second molar the palatal root exhibits at its apex a cauliflower-like excrescence, upon a comparatively smooth osteoma, about one millimeter in thickness, occupying the upper two-thirds of the root. The excrescence sends a delicate conical offshoot to the mass which cements the buccal roots together. The posterior portion of the crown of this tooth has a carious cavity in

it the size of a French pea, with the pulp-chamber opened. (Fig. 4, *b*.)

Roots of this kind look very clumsy and shortened, for the reason that at the place of their union the hyperostosis forms a heavier mass, which has more or less filled the space between them; still they remain separate to a considerable extent.

III. Diffused Hyperostosis with Roots United.

This group may be subdivided as follows:

A. Apices free and straight.
B. Apices free and curved.
C. All roots united their entire length.

Teeth of group A are characterized by an osseous outgrowth of cementum accumulating at the point of junction of the roots,—the roots themselves being either slender and free from osteoma or

Fig. 5.

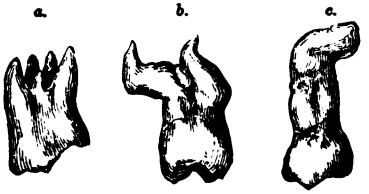


Fig. 6.

slightly thickened. An upper wisdom-tooth presenting this anomaly has five roots, three of which are normal at their apices, the fourth being the seat of a diffused hyperostosis encircling it, and the fifth root being rudimentary. All, however, are united into a common mass a short distance from their apices, which mass gradually blends with the enamel. (Fig. 5, *a*.)

Teeth of group B exhibit a union of the roots with markedly devious but slender apices. A left upper second molar of my collection shows this evidently rare anomaly. The palatal root is slightly devious, with an apex arising from the main mass of the root at a right angle. The buccal root (there is but one) shows two curvatures, both at right angles. The osteoma is only moderately large, and on the posterior surface, at the point of junction of the roots, there is wedged in a sessile oblong nodule, below which is a shallow

furrow, indicating the original point of separation of the two roots. The crown of this tooth is not decayed. (Fig. 5, *b*.)

Teeth of group C are rather common. In third molars or wisdom-teeth, both of the upper and lower jaws, a union of the roots is quite generally their normal condition. Osteoma, when found upon such roots, is either a clumsy nodular mass without any sign of a previous separation, or slight furrows may be visible indicative of such separation of the roots. (Fig. 5, *c*.)

There is a history connected with a lower left wisdom-tooth in my collection which I will give in abstract, feeling that it may be of interest to some who may hear or read it. It exhibits a diffused osteoma, ridged and nodulated, with a bent apex toward the ramus. It was extracted from the mouth of a lady some years since by my friend, Dr. S. A. Main, of this city, who kindly presented it to me with the following history: For some ten years this lady had suffered most excruciatingly from facial neuralgia. She consulted the best medical talent at home without obtaining the slightest relief. Finally, some three years before the tooth was removed, she went to London, where it was determined by the surgeon who was called to attend her that, in order to afford any relief, it would be necessary to sever the facial nerve upon the side which seemed the most affected, which operation was done,—with, however, only temporary relief. With the hope that the slight cessation of pain would be speedily followed by permanent cure, she went to Paris, anticipating the pleasure of a comfortable tour of the Continent, where in a few days the pain again returned with renewed energy. She there consulted a surgeon, who decided that the only chance for permanent relief was to have the facial nerve divided upon the other side of the face. The operation was done with no better results than from the first. Finally she concluded to return to her home in New York, there to spend the few days (as she supposed) which she had to live as comfortably as possible. Shortly after arriving at her home she consulted her dentist (whom, by the way, she had never thought to consult before in reference to her neuralgia), and asked him to look at this tooth, saying at the same time that it often felt quite sore to the touch. (Its antagonist had been taken out many years before.) After examination, she was advised to have it taken out, which was done. Immediately upon its removal the lady realized that the cause of her long-continued, fearfully distressing, and very expensive neuralgia had been found at last, which proved to be true. She then told Dr. Main that that tooth had cost her ten thousand dollars.

IV.—Union of Two Teeth through Hyperostosis.

Of this rare occurrence of the osseous union of teeth I have some eight fine specimens. The subdivision suggesting itself is as follows:

A. Union of the roots at their apices (Fig. 6, *a b*).

B. Union of the roots at their middle (Fig. 7, *a b*).

C. Complete union of the roots (Fig. 7, *c*).

The first group is characterized by a union of devious roots of neighboring teeth. As both of my specimens show a partial carious destruction of their crowns, the idea may suggest itself that, owing to a destruction of the intervening alveolar wall, and owing to gravitation, the roots became attached to each other through an inflammatory process. At the same time serious objections may be raised against such a view. The main objection is that an inflammation of the pericementum sufficiently intense to destroy the alveolus would be very liable to destroy the pericementum itself to such a degree as to render the secondary new formation of cementum necessary for agglutination of the neighboring roots quite impossible. Should we assume that the septum was originally absent, the only way of explaining such formations is to assume that at least one of the germs of the coalesced teeth was malposed at the time of the embryonic arrangement. In this view, it will be observed, the alveolar septum did not form at all, and at the time of development of the roots the mutual pressure was sufficient to cause irritation leading to a new formation. I conclude, therefore, that the carious destruction of the crowns was merely a coincidence rather than a cause (Fig. 6, *a*). The roots of one tooth are mere stumps left after carious destruction of the crown and a portion of the roots. Here the hyperplastic cementum of the stumps is jagged and nodular, plainly indicating that the already formed outgrowth of cementum has been destroyed by cementitis in rather a secondary manner. (Fig. 6, *b*.)

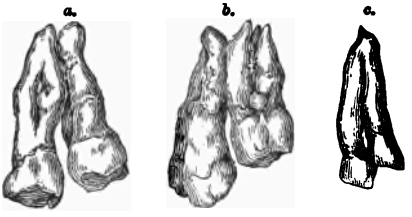
Group B shows a union of neighboring roots of molars at the middle upon one side, and at the apices upon the other (Fig. 7, *a*). One of the crowns is slightly affected by caries,—by no means, however, to such a degree as to account for agglutination of the two teeth, the enlarged cementum of which is mainly smooth. Fig. 7, *b*, represents two molars grown together nearly the entire length of their roots; both teeth being otherwise sound. One of them shows at its neck an "enamel-drop," which feature I consider a further proof of embryonal malformation of such teeth. Some exostoses from the

sockets are attached to the roots, which in my judgment proves merely a secondary hyperplastic pericementitis.

Group C is represented by but one specimen,—that of an upper cuspid united with a neighboring lateral incisor. This seems to be a case which may be considered an exception to the rule, viz: that only bicuspids and molars are thus affected. In this case the union is perfect the entire length of the roots, and only shallow furrows on the outer and inner surfaces, reaching nearly to a common apex, indicate the previous separation. The apex presents but one large common foramen. At the necks of both teeth there is shallow carious destruction,—not, however, exposing the pulp-chambers. All these features furnish us proof of a fetal malformation.

For the purpose of examining this disease microscopically, I have ground quite a large number of specimens from teeth which at the time of extraction were immediately placed in dilute alcohol, in order to keep them constantly wet and preserve their soft parts. During the process of grinding they were also kept under water.

FIG. 7.



All specimens showed in common a number of features which are represented with a comparatively low power in Fig. 8. Those which I wish to call attention to are as follows:

The dentine in some specimens, perhaps in several localities in the same specimen, was found in a normal condition; and in others it exhibited the so-called interglobular spaces, greatly varying in size and number, indicative of an incomplete calcification.

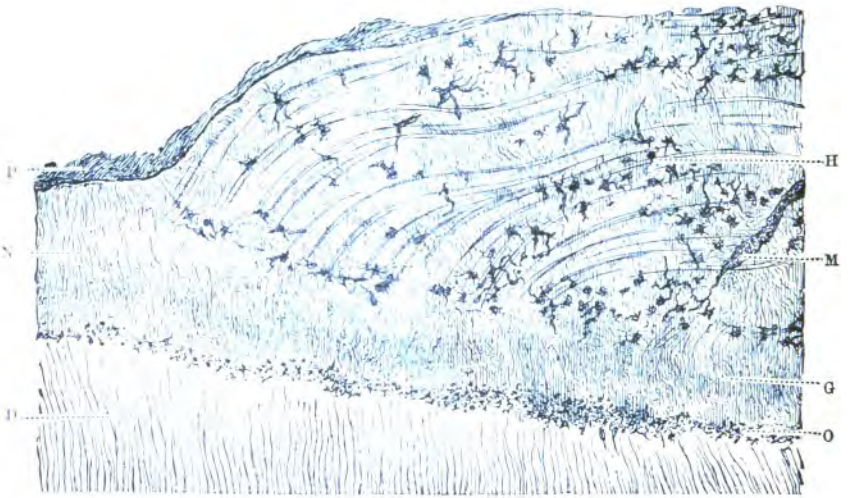
In some specimens the dentinal canaliculi of the root were arranged in bundles, between which were found areas scantily provided with or altogether destitute of canaliculi. In these areas are often seen small interglobular spaces, sometimes in direct union with a few canaliculi.

The interzonal layer between dentine and cementum invariably exhibited formations known under the name of osteo-dentine, or globular dentine, either as the result of "eburnitis" or of incomplete calci-

fication. It is a condition kindred to the interglobular spaces of Czermak. Such formations, as a rule, extend into the neck of a tooth,—where, however, they are more scanty than on the roots. A striking feature is their entire absence at the point of junction of the roots. Here the cementum is found in contact with an irregular formation of dentine (vaso-dentine), which will be described further on. Wedl seems to have been the first to illustrate this formation,—without, however, making an allusion to it in his text.

Next to the layer of osteo-dentine is found invariably a layer

FIG. 8.



LONGITUDINAL SECTION OF HYPERPLASTIC CEMENTUM SLIGHTLY BULGING TOWARDS THE NECK OF THE TOOTH (UPPER BICUSPID).

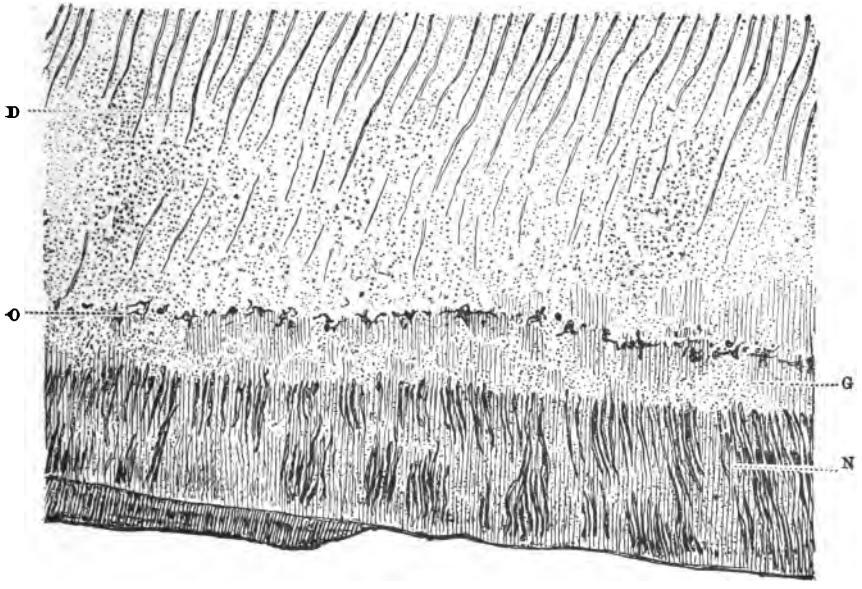
D, Dentine; N, Neck; P, Pericementum; O, Globular or osteo-dentine; G, Granular layer; H, Hyperplastic cementum irregularly lamellated, with irregularly distributed cement-corpuscles; M, Medullary canal. X 150.

which, under lower powers of the microscope, looks coarsely granular, and which in consequence I propose to call the granular layer. It is destitute of cement-corpuscles, and as a rule is the only layer comprising the cementum of the neck of the tooth whenever this gradually slopes from the hyperplastic cementum to the enamel. Next follows the enlarged cementum itself, usually characterized by a large number of irregular lamellæ more or less concentric to the axis of the root. Some areas may be found destitute of lamellæ; others very richly supplied with them. At the border of the ce-

mentum toward the crown, where the former is often found bulging to a considerable extent, the lamellæ are found parallel with the outer periphery of the cementum, inosculating with the granular layer at obtuse angles.

In the lamellated basis-substance are found scattered cement-corpuscles. The most striking features of these corpuscles are as follows: First, they are far more irregularly distributed in the basis-substance than in normal cementum. In some portions of the hyper-

FIG. 9.



HYPERPLASTIC CEMENTUM OF THE NECK OF A MOLAR. LONGITUDINAL SECTION.

N, Zone of coarsely-granulated cementum, traversed by bundles of coarse canaliculi; G, Granular zone, destitute of canaliculi; O, Zone of globular dentine; D, Dentine with canaliculi stopped short of the cementum. X 500.

plastic cementum such corpuscles are comparatively few, whether the lamellæ be plainly marked or not; in other portions they are arranged in groups or clusters without apparently any regularity. Second, the cement-corpuscles, as a rule, are smallest near the granular layer, and largest toward the periphery; at the latter portion their offshoots are much wider and more irregular, often piercing the lamellæ rectangularly. No constant relation between lamellæ and cement-corpuscles is to be found. Third, occasionally the cement-

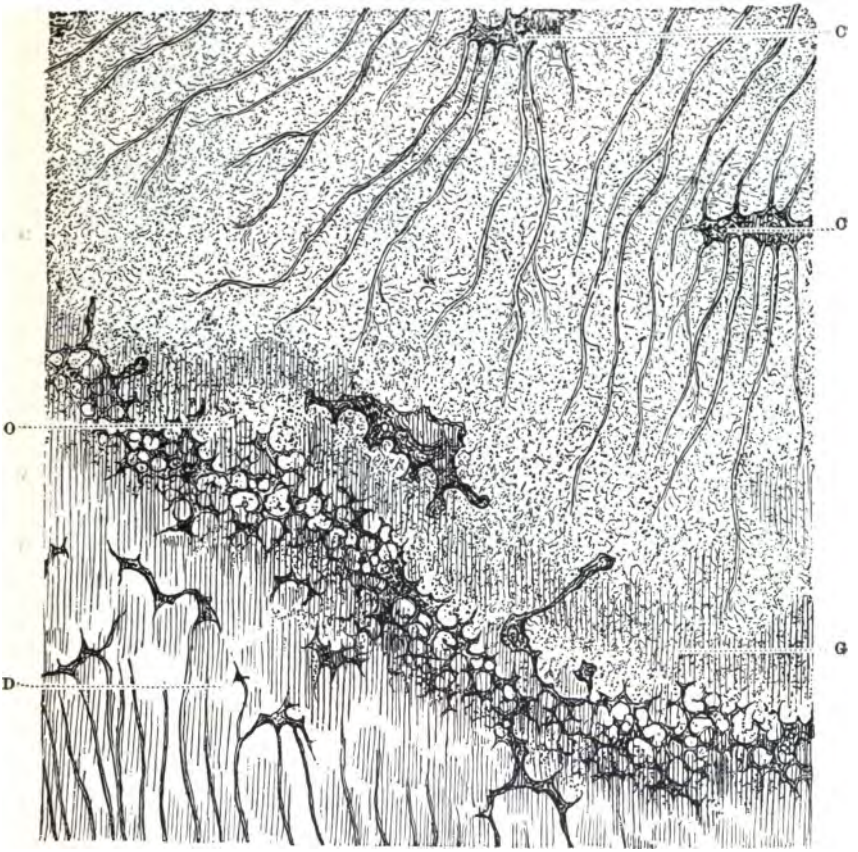
corpuscles are to be seen in large numbers clustered together in longitudinal groups. This is probably caused by the previous presence of medullary canals, the tissue of which, at a comparatively late period, has given rise to a large number of cement-corpuscles, and a comparatively small amount of basis-substance between them.

The hyperplastic cementum is often traversed by medullary canals carrying central blood-vessels. These are most numerous at or near the point of junction of the roots, where, as first described by Tomes, even normal cementum may sometimes contain medullary canals. The vessels of these medullary canals, also first described by Tomes, with whom I am pleased to agree, are in direct connection, and anastomose with the blood-vessels of the pericementum. In one of my specimens the cementum of the neck exhibits peculiar features. Instead of the coarsely-granular layer usually present, and previously alluded to, there is a zone traversed at nearly right angles by bundles of canaliculi, very broad and in no connection whatever with cement-corpuscles. Above this zone follows the ordinary granular zone, bordered towards the dentine by a thin layer of globular dentine; then follows the finely-granular layer of the dentine itself, with very few or no canaliculi, and at last we come to the canaliculated dentine of normal development. (Fig. 9.)

High amplifications plainly reveal the structure of the interzonal layer between dentine and hyperplastic cementum. The dentine often shows interglobular spaces, which as a rule are filled with granular protoplasm, and serve as the termination of some dentinal canaliculi; especially for their tenants, the fibers of living-matter. The interglobular spaces nearest to the cementum sometimes directly inosculate with the interstices between the globular masses of calcified basis-substance, constituting the tissue termed osteo-dentine or globular dentine. The globules themselves vary greatly in size. They usually, however, correspond with the bulk of one or a limited number of medullary corpuscles present before their transformation into basis-substance. The interstices between the globules also vary in size, and send offshoots into the larger globules, subdividing them into incomplete smaller ones. All of them contain granular protoplasm. In the granular zone following the layer of osteo-dentine we sometimes meet with very large and irregular interglobular spaces, apparently in no direct connection with the offshoots of cement-corpuscles. In several specimens I have seen arising from the cement-corpuscles very long and slightly wavy offshoots, which, owing to their parallel course, bear a close resemblance to dentinal

canaliculi. Formations of this kind occur only in those layers of hyperplastic cementum nearest to the dentine, and always lose themselves in the granular layer above the osteo-dentine without directly communicating with the dentinal canaliculi proper. (Fig. 10.) The

FIG. 10.



INTERZONAL LAYER BETWEEN DENTINE AND HYPERPLASTIC CEMENTUM OF A MOLAR. LONGITUDINAL SECTION.

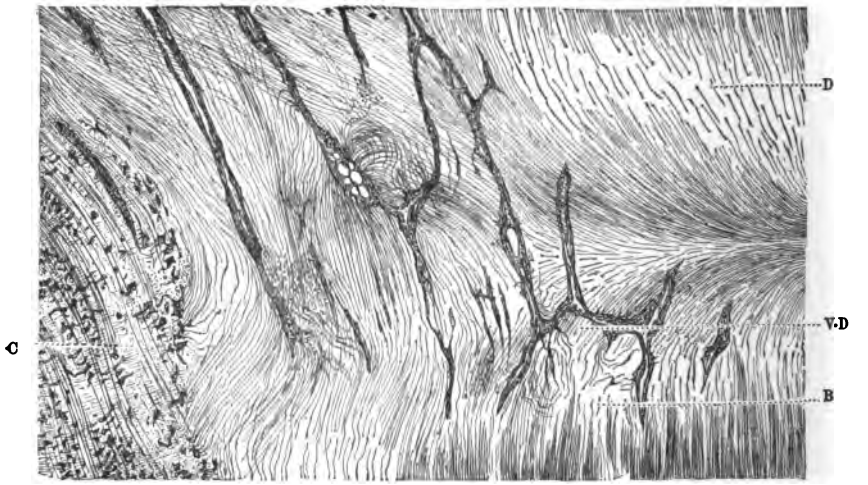
D, Dentine with small interglobular spaces; O, Osteo-dentine, above which, in the granular layer G, there is a large, irregular interglobular space; C, C, Cement-corpuscles with long parallel offshoots. X 600.

medullary canals traversing the enlarged cementum either contain medullary corpuscles and capillary blood-vessels, or they are filled with highly-refracting granules and globules of lime-salts, as de-

scribed by Wedl. Should their canals become obliterated, they give rise to groups of cement-corpuscles between a scantily calcified basis-substance.

At the point of junction of the enlarged roots I have met in several of my specimens with a peculiar formation of dentine, and owing to the presence of a large number of vascular canals I propose to term it vaso-dentine. To the naked eye, in the prepared specimen, it presents a high degree of transparency, which at once distinguishes it from the neighboring opaque portions of normal den-

FIG. 11.



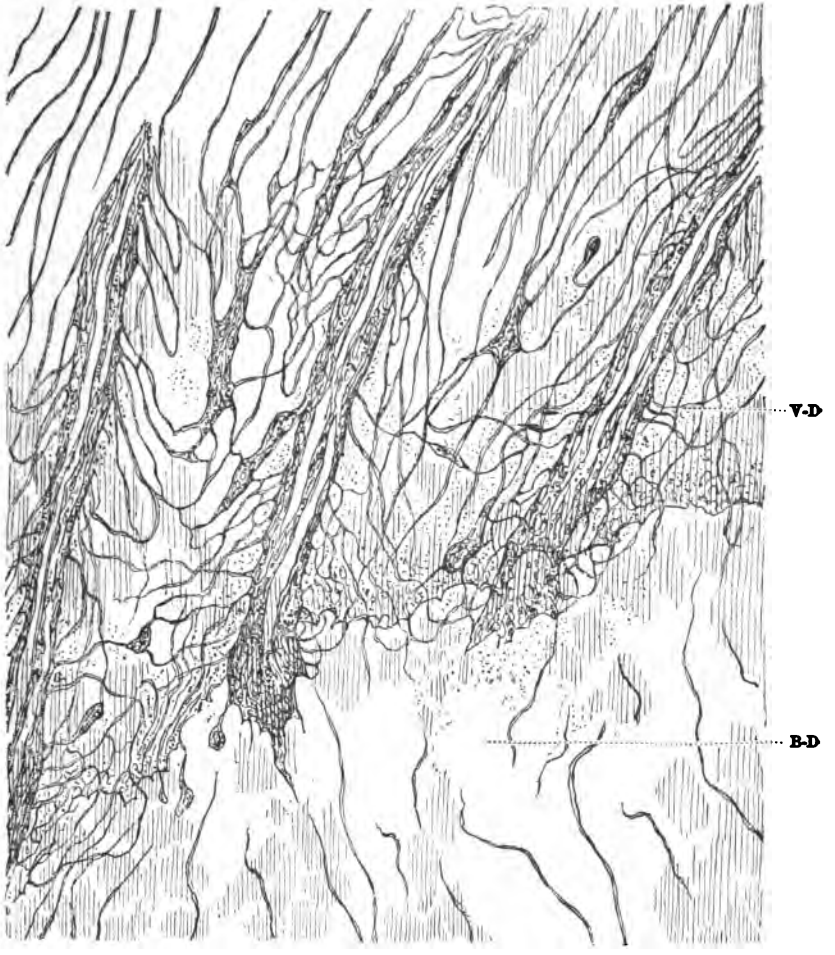
VASO-DENTINE FROM THE JUNCTION OF THE ENLARGED ROOTS OF AN UPPER MOLAR. LONGITUDINAL SECTION.

D, Primary dentine; V-D, Vaso-dentine traversed by medullary canals in a plexiform arrangement The canals contain either blood-vessels or glistening depositions of lime-salts. B, Basis-substance of dentine scantily provided with extremely delicate canaliculi, and in some places fan- and fountain-shaped figures of dentinal canaliculi are discernible; C, Hyperplastic cementum lamellated, and containing a medullary canal. X 50.

tine and from cementum. Low powers of the microscope reveal in this dentine a varying number of medullary canals, either in a parallel or plexiform arrangement. The canaliculi contain medullary tissue and capillary blood-vessels, one or two in each canal. Sometimes glistening granules of lime-salts are found, more especially in dilated portions of the canals. Offshoots of such canals may inosculate with very narrow canals, containing granular protoplasm only. The surrounding basis-substance is scantily supplied with extremely fine

canaliculi, running, without any apparent regularity, either in fan-shaped groups or parallel with the medullary canals, or in the shape

FIG. 12.



VASO-DENTINE FROM THE POINT OF JUNCTION OF THE ENLARGED ROOT OF AN UPPER BICUSPID. LONGITUDINAL SECTION.

V-D, A portion of vaso-dentine with three parallel vascular canals, and very irregular, often looped, canaliculi, some starting from the vascular canals and others from smaller medullary spaces. B-D, Dentine of great transparency, with scanty canaliculi. The boundary line between the two portions is abrupt, with numerous bay-like excavations. X 500.

of a fountain, encircling the canals in the most beautiful and striking figures. Some portions of the basis-substance may look granular

and devoid of canaliculi; others (and these formed a vast majority) are apparently homogeneous, and scantily supplied with extremely minute canaliculi. The cementum is directly on the border of the vaso-dentine, without any intervening layer of granular dentine, and the cement-corpuscles nearest to the dentine are in direct connection with the dentinal canaliculi themselves. (Fig. 11.) Higher powers of the microscope brought to bear upon the vaso-dentine plainly show the medullary contents of the medullary canals, in which may also be seen one or two capillary blood-vessels. Both the canals and blood-vessels produce loops, as indicated by their abrupt terminations in vertical sections, and are unquestionably in communication with the blood-vessels of the pericementum (Tomes). A peculiar feature of the vaso-dentine is that portions freely supplied with vascular canals contain a considerably larger number of dentinal canaliculi than those devoid of vascular canals.

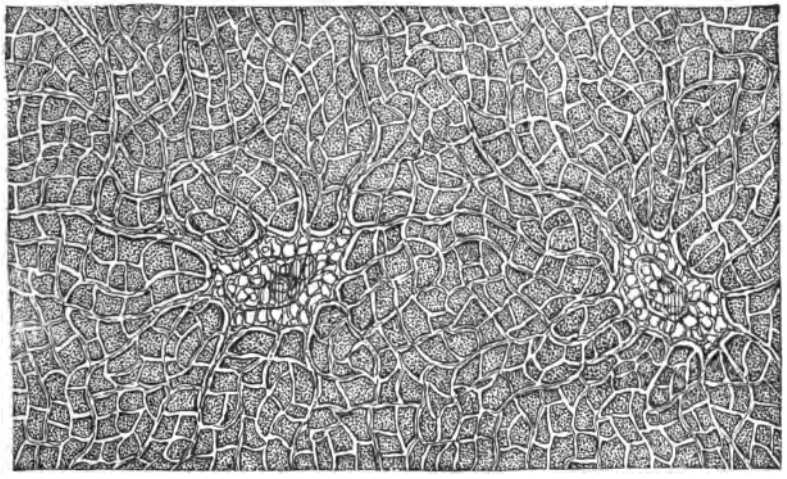
The canaliculi in the neighborhood of the vascular canals are very irregular in their course, as before stated, and often loop-shaped, starting from and inosculating with the same vascular canal. Again, we find them starting from club, pear, spindle, and irregular-shaped spaces, containing medullary corpuscles, or granular protoplasm, but no blood-vessels. (Fig. 12.) As an additional feature of hyperostosis of the roots, I would mention that in all my specimens the pulp-chamber and often the canals appear considerably narrowed by heavy formations of secondary dentine. Besides, the pulp-tissue was found to contain formations of secondary dentine known as pulp-stones, or crowded with globular calcareous depositions with no apparent structure. In the majority of the teeth the enamel also was imperfectly formed, it generally presenting a highly pigmented and imperfectly-calcified condition, with enamel-rods very irregular and curly.

A striking feature in all microscopical specimens of hyperplastic cementum is the great number and large size of the offshoots of the cement-corpuscles, the previously so-called canaliculi. The reason for this seems to be in the fact that both the corpuscles (lacunæ) and their coarser offshoots (canaliculi) are filled with air, or dirt from the grinding, which causes them to look black. If, however, we place a carefully but not completely decalcified portion of this tissue, mounted in glycerin, under a very high power, we are struck with its beautiful and graceful appearance. It is identical in structure with that of normal cementum. The basis-substance forms cavities that contain nucleated protoplasmic bodies, the cement-corpuscles proper, of a markedly reticulated structure.

Between the periphery of the cement-corpuscles and that of the lacuna there is a narrow light rim, obviously corresponding to a space that serves for the circulation of the nutritive liquids. The lacuna at its periphery is interrupted by numerous offshoots, more irregular and wider than those of normal cementum. These canaliculi form an extremely delicate reticulum throughout the basis-substance, interconnecting the neighboring lacunæ (indeed, all lacunæ) of the cementum.

Starting from the periphery of the cement-corpuscles, conical offshoots run into the canaliculi; the broader, of course, the wider the

FIG. 13.



HYPERPLASTIC CEMENTUM OF AN UPPER MOLAR. CROSS SECTION. X 1500.

canaliculus. The coarsest offshoots still exhibit a reticular structure; whereas the finest are merely beaded threads occupying the middle of the canaliculi. Thus it will be seen that all canaliculi hold filaments of living-matter in a cobweb arrangement, and thus it becomes plain that hyperplastic as well as normal cementum is a living tissue throughout. The reticular structure of the living-matter in the corpuscle itself is plainly visible. The inert basis-substance, infiltrated at the same time with lime-salts, is located in the meshes of the reticulum of the canaliculi, and between the basis-substance and filaments of living-matter a slow circulation is going on, the liquid carrying nourishment and taking away the effete material. (Fig. 13). Thus it is that pathological changes of a pathological

tissue become intelligible, and cementitis of hyperplastic cementum, as described and illustrated by Wedl, under the term "perforating resorption," is understood.

Macroscopically I have already described this condition. Under the microscope it is characterized by the presence of cavities filled with medullary corpuscles, or multinuclear protoplasmic masses, and bounded toward the unchanged cementum with numerous bay-like excavations. The destruction may involve superficial portions of the tumor only, or the entire mass down to the dentine. As there is little tendency to suppurative pericementitis, the termination of the inflammatory process undoubtedly results often in a re-formation of cementum, the same as takes place during the process of absorption of the roots of temporary teeth. Under these circumstances the bay-like excavations are refilled with bone-tissue, and the bays are recognizable by sharply-defined lines corresponding to the territories of the cement-corpuscles. Some of my specimens exhibit bay-like excavations directly separating the cementum from the dentine, and the bays filled with bone-tissue crowded with cement-corpuscles. In other specimens certain portions of the hyperplastic cementum show distinct circular, semicircular, or crescentic lines corresponding to the territory of one or more cement-corpuscles.

Those who wish to study and know the literature of this subject I will refer to the following authors, viz: John Hunter (under the heading of "Inflammation of the Roots"), "Natural History of the Human Teeth," etc., 1778; Joseph Fox, "Diseases of the Teeth," etc., 1806; Thomas Bell, "Anatomy, Physiology, and Diseases of the Teeth," 1831; Carabelli, "Systematic Handbook of Dentistry," 1844; Wedl, "Pathology of the Teeth," 1872; J. and C. Tomes, "Dental Surgery," 1873; Garretson, "System of Oral Surgery," 1873; Bödecker, "Pericementum and Pericementitis," *Dental Cosmos*, 1879–80.

DISCUSSION.

Dr. W. H. Atkinson: This is a question that ought to command our earnest attention, for it lies at the foundation of all the clean work that can be done by our members. It is, as it were, but in its infancy. When the old solidal pathology held sway, nothing was known without examining how solid bodies moved, and when it was sure that the blood and mucus and lymph had something to do with the well-being of animal bodies, the fluidal or humoral pathology came into existence, and in the investigations as to how function was

performed, in view of the operations of solids and fluids, it was undertaken to find the locality in which these actions did take place, and Schwann and his confrères brought in the cellular pathology, after having observed first the then condition of the conversion of protoplasm into the structure of bodies in the vegetable kingdom. Cellular pathology held sway for a short period, and is not as yet entirely given up. *Now* the pragmatic pathology has come in, by our seeing that all that is operated in functional bodies is the effect of some unseen element that works the changes inside and outside of the so-called cells; and the paper that was read last night and the drawings that were presented are stepping-stones, to show as far as possible the ultimate elements in the elemental bodies in which these changes take place that are called nutritional, and what would be of the greatest advantage to us is, to throw away all irrelevant matter and go directly at the work, to see if we can comprehend how it is that these changes do take place, so that they can be seen and diagnosed, as so beautifully displayed in this hyperostosis, as it is called. By the aid of the microscope, we are trying to get at the work that has already been effected, that only reveals the plan and mode of the arrest of the radiance, by which I mean light and plus, which means energy, that has converted all these foods into protoplasm, so as to take from an almost homogeneous substance, which is the storehouse of the radiancy that in its different degrees of embodiment shall constitute bodies that we can see. What is the first body that we can see? It is a granule. No man can see a molecule. No amplification of power of any microscope that has yet been discovered has been able to get at it. I call it an ideal body, and the statements are made merely as crutches to help our minds to grasp the perception of what afterwards becomes competent to be perceived by our senses. These drawings are the valuable part of it. If I had the time and willingness and you the patience to go over the paper and show what is worthy of attention, and what is doctrine and what is fuss and feathers and flummery and false deduction, I might bless you and be blessed. The time has gone by when domination can hold sway any longer on earth among men. We do not say "Be damned" any more; we say, "Let us see." These papers are, as Prof. Abbott has justly said, the culmination of drawings. I don't know but there are surprises for us,—that some young man may not transcend all this the next time we come together, and set men into a dynamite explosion. I will try to say something that will at least find lodgment in your

minds enough to inspire you with a desire to know, so that you may make investigations. As to the doctrine. The doctrine that was pronounced as settled is not settled at all. It is a mere hypothesis and an assumption, and that is what has ailed us all the way through; that we assumed a knowledge we did not have, and set forth as ex-cathedra, and required men to subscribe to it or be put out of the synagogue. "The Lord is in His holy temple; let all the people keep silence before Him," was said of the Elohim of the Hebrews long ago. Since that we have ceased to follow immediate leaders, and we have had our leaders back in the same class with only one single term ahead. The assumption that hyperostosis occurs in utero and during the development of the teeth with living pulps is an assumption, and not proved. I do not think it ever will be proved. There are too many circumstances that indicate to us that this deflection of the store of radiancy was not potentially resident in the tooth-germ, so that by possibility all the nutriment or new impact of energy that would stop the deflection would get increased deposits of, first, protoplasm, and then embryonal corpuscles, and then the cementoblasts, and then deposit the lime-salts, to make it hard enough to hold it, so that it could be cut and made visible in the section we have. The very fact of roots of teeth having ten to twelve or fifteen distinct laminæ of cement-corpuscles laid on them, and obliterating all the intervening spaces that were once traversing the alveoli, and fusing with the adjoining tooth, as I have seen five teeth right along, all extracted in one solid phalanx, —to say that they could have occurred before the teeth were erupted is contradicted by the line upon which we find them standing. If I have had a glimpse of the law, it is want of use that raises the mischief among us always, of rheumatism, gout, tumor, cancer. It is the lack of the togetherness of use that induces the impact. Energy is expended upon the function of the tooth in occluding against the other one, and does not order the deposit of the lime-salts that are in the neighborhood, so as to encroach upon the socket and at last unite with the other tooth adjoining it. You will find that the so-called peridental membrane leads us a great way into trouble. Every membrane has a basis of connective-tissue corpuscles as its stratification or foundation-stone, and when they tell me that you must save the periosteum if you expect to get reproduction of bone, they are in fault. It is not the periosteum that is the bone-producer; it is the substratum of osteoblasts that lie immediately between the periosteum and the formed bone to which we must look

as the immediate antecedent of the production of the bone or the cementum. We need in our intellectual growth to do as we do in our bodily growth. We need to take the breath in, steal out of it that which we need, and expel and not take in that breath again. We never do take any of these steps twice. We cannot by any possibility do it mentally or bodily, but to carry us to the point where we get the conception of how the so-called forces are differentiated into the bringing-up of the five tissues constituting the body, and how they are maintained during the lifetime of the possessor of the tissues, is what we desire to get at. I have tried to follow the line in my own mind, but as I say it was a miscalculation to make a deduction, and it ought not to be presented in a paper where there are men who are less endowed with the understanding of the subject than the man who reads the paper and makes the investigation. Whether he reads it originally as his production or that of somebody else does not matter so much; but if you knew how my protoplasm boils when I see men using other men's ideas and not being quite full in their apprehension and acknowledgment, you know if I *could* fight, that is when I *would* fight; but it is not contention that we need but emulation,—who shall do the work best. Then I would not have so much of this brush in the way to cut, before I could get at the point that would enable you to get the conception of these tissues, that comes from an endowment which is entirely beyond the range of sense. No man knows why. I do not know the why of anything. We ask how it is. That is what the microscope can reveal, but when does it reveal it? After the work is done. After the man is dead they will cut him up and tell what ailed him. They don't know what ailed him. They have simply the tracks that the ghost left, and they describe that as disease. These are provisions of this little embodiment of energy to maintain their possession as long as possible, as each one of us tries to maintain his possession as long as possible, and however retiring and sylph-like he may be, you put him far enough to the corner, and he will fight like a cat for his individuality. These fellows are doing this very thing by building so much of this pericementum here as to make a mass that was called exostosis. We say arsenic caused the mischief, when it was the energy that lay behind the arsenic that caused the mischief, and the arsenic was the vehicle. Arsenic is a metal, has no affinity for any of the tissues, and it must be oxidized or have some agent in contact with it that changes it from a metal to a salt, and then, when that

molecule is broken up by reason of the pabulum in the tissue having a greater affinity for the oxygen (that is made oxide of arsenic) than the arsenic has for it, an unmarrying and disruption of the molecules take place, and that is where the poisoning comes in. All the salts hold the same law. All the ashes hold the same law. Ashes are the product of burnt metals. This is the divine word of truth and soberness, if you will only allow your minds to be so set upon it until you can catch the stored radiancy and store it to be useful to you afterwards. The law of nutrition begins upon the same principles. It has the type behind it. That type is the mode of storing radiance, and that gives us variety of the inhabitants of the planets, and that is the point they have been dealing with. We know the Darwinians and the evolutionists have been trying to find out how they could distinguish between species and variety and genus; that it was this inherited past molecular experience of ancestral activities that had been stored in the protoplasm, from which the new germ was produced, from which the body, teeth and all, comes out by the expression of the re-awakened energies.

DR. A. H. THOMPSON: Dr. Abbott has again placed us under obligations to him for one of his classical productions, which we shall be better able to comprehend by leisurely study after its publication.

It has occurred to me that there might be such a thing as a *nodular diathesis*, or idiosyncrasy, in which nodular growths are produced on other bones of the body, as well as upon the teeth. We know there are growths on other bones, and it would be interesting to observe by post-mortem examination when exostoses occur on the teeth, if they are accompanied by growths on the other bones in the same individual.

DR. ATKINSON: I offer a Delmonico dinner and a pair of clean sheets at my own house, and a week's lodging, for a specimen of hyperostosis, or so-called pericementosis, upon a tooth that has never lost its occlusion. Thumb-suckers and mouth-breathers are the people who have these troubles.

DR. INGERSOLL: I wish to speak in the highest commendation of the paper, as being in the right direction of investigation in fields that are not well known to us. Progress is what we desire. There are two or three points only which I shall refer to. That first introduced in the paper had reference to inflammation of dentine. There are many of us here who remember that sort of phraseology

twenty-five years ago. It was then said that we could not properly speak of inflammation of dentine, and a compromise was made, and the term *sensitive dentine* was adopted. Do the terms inflamed dentine and sensitive dentine mean the same thing? That which I understand as sensitive dentine is emphatically inflamed dentine; and there is such a thing as inflammation of the hard tissues, not excepting the dentine. The objection raised to that statement of the case is this: Inflammation implies vascular action. Is there any vascular action in dentine? I have been in the habit of viewing the subject in this manner: It is not necessary that a tissue manifest every process of inflammation before it may be said to be inflamed. We may have some manifestations of inflammation in one tissue which do not appear in another. All are not equally vascular. We know that there is such a thing as inflammation of cartilage, yet that is not a vascular tissue. It borrows its vascular supply from the surrounding tissues, and its pathological conditions also. It has been suggested that the blood-corpuscles cannot enter the tubules of the dentine, and therefore there can be no such thing as inflammation of the dentine; but the entrance of blood-corpuscles is not necessary to inflammation. Is there a circulation in the dentine? That is the question. We must all say yes; there is nutrition, therefore there must be circulation, and an activity in promoting it, allied to vascular action. Now, concerning sensation. The dentine is not *peculiarly* sensitive,—that is, it is not in a pathological condition until it becomes inflamed; nor is the pulp itself. I see no impropriety, therefore, in speaking of inflamed dentine. In dental science we have discovered that neither in structure nor in chemical constituents is tooth-substance *bone*. There is no anatomist today that recognizes cementum even as perfectly identical with bone. Hence we call it *cementum*. The phraseology which Dr. Abbott used last night was hyperostosis. Why not call it excementosis, dropping the syllable *os* as pertaining distinctly to bone-structure? Then we shall have a nomenclature of our own in harmony with dental science, and which would distinguish an excessive deposit of calcareous matter upon cementum from a calcareous deposit upon normal bone. One word with reference to the nature of this deposit. Is it proper to speak of it as hypertrophy? Has it the characteristics of hypertrophy, or of tumefaction, which? I look upon it rather as a tumefaction than a hypertrophy. We may have such a thing as hypertrophy of the cementum, but it is physiological and not pathological. Physiological hypertrophy is the result of exces-

sive *excitation*. Excementosis is pathological and results from *irritation*. All the functions of the body are set into operation by normal *excitants*, but not by *irritants*, and yet a normal excitant may become an irritant by being excessive.

All teeth do not have the same thickness of cementum. There is a great variation in that respect, depending upon the degree of normal excitation of the organs. Teeth that are used thoroughly in mastication will very likely be found to have thicker cementum upon their roots than teeth that are not thus used. Such teeth may have physiological hypertrophy, not pathological excementosis. One is a healthy condition and the other unhealthy. If we accept the theory of inflammatory action in dentine, it furnishes to my mind another factor in the process of dental decay. The processes of nutrition are similar throughout the entire body. So are the processes of inflammation and of destruction.

The dentine and the bone are constructed on very much the same plan, the only difference being that one is a tubular structure and the other a cancellated structure. If we study inflammation in the bone, we will find that the medullary portion is that part in which are developed the active processes of inflammation. The expansion of the tissue under inflammation takes place at the expense of the walls of the cancelli; thus we have the *softening process* of bone. We may have precisely the same thing in the dentine; namely, the expansion of the dental fibrils at the expense of the intervening hard tissue, resulting in what we call demineralization. So that we do not get an explanation of the *whole* of the process of decay through either the germ theory or the acid theory. We need the inflammatory theory before we have the whole, operating, as I have observed, in the demineralization of dentine.

DR. WELCH: I understood Dr. Atkinson to say he never knew of a case of hypertrophy of the cementum of a tooth where it had natural proper occlusion.

DR. ATKINSON: You understood me correctly.

DR. WELCH: He offered so many good things to one who would show him a case, that I do not think I can miss them. I had a tooth extracted myself that had a proper and natural occlusion, and was hypertrophied. Dr. Fuller extracted it for me, and I think will testify to the same.

DR. ATKINSON: The most profitable thing I can say to you is this, that we have two modifications of physiological action; one is called hyperintrusion and the other is called marasmus. It is the ante-

grade or retrograde movement of the currents of nutrient activity that produces these results. We see in the one case it produces the example before us; in the other case where the irritation so-called has taken the reverse current; the cement and the interzonal layer of corpuscles have been taken off the dentine, leaving pointed roots of teeth in aged persons.

DR. MORGAN: I regard the paper read last evening as one of very great value, and the drawings exhibited the most beautiful I have ever seen. Most of what was stated in the paper, as far as I understood it, I accept, but there were some inferences drawn that I think are incorrect. I shall allude to but a single one of them. The statement was made that this hypertrophied condition or increase of cementum upon the roots of teeth never occurs after the destruction of the pulp. I take issue with the writer upon that subject. The investing membrane of the tooth continues to be a functioning organ after the destruction of the pulp, and, as this hypertrophy or increase of cementum is necessarily the result of the functioning of that membrane, it may occur at any time while that membrane is in a living condition. The membrane being entirely independent of the pulp of the tooth, having no direct connection with it, I cannot see how any of its functions would be destroyed by the destruction of the pulp. My friend, Dr. Ingersoll, made a very clear, concise talk, and opened up to my mind some avenues of thought that had not previously occurred to me, and yet he assumed some points upon which I must differ with him. For instance, he claimed that all sensitive dentine is in an inflamed condition. I take it that the teeth are somewhat analogous to other structures of the body, in their manner of function and sustenance. We have in general surgery what is called healing by first intention, a process in which it is now claimed there is no true inflammation. But there is a great increase of sensibility at that point, and it is contended that it is the result of irritation only, and not of true inflammation. I hold that the same may be possible in the teeth. There is an effort in nature toward repair when by attrition the tooth is worn down, in which the tubuli are filled in with lime-salts and the tooth becomes eburnified. May we not have in the teeth exactly a corresponding condition to that which occurs in healing by first intention, and may not the increase of circulation in that case explain the increase of sensible pain in the softer parts. That there is inflammation in dentine, I do not for a moment question, and I think Mr. Tomes's observation, demonstrating the enlargement of the dentinal tubuli, would settle that question if there was no other proof.

DR. INGERSOLL: May I correct a mistake which Dr. Morgan has made? You remember I put in one word which the doctor left out; I said any *peculiar* sensation. There is sensation of the dentine, but not a painful sensation; it is simply the normal physiological sensation. When that *peculiar* sensibility exists and gives the twinge of pain, *that* is the evidence of inflammatory action. With regard to the illustration which he gave of healing by first intention, in which there is no inflammation, I think we have all been utterly confused in reading different authors with regard to the use of the term inflammation. Stricker, in the "International Surgery," uses the word inflammation as having reference almost exclusively to the suppurative stage, and you might well imagine that he did not mean anything else but suppuration whenever he spoke of inflammation. Another man means nothing but hyperemia. Another refers to some other feature of it, and uses the term uniformly in that relation. Stricker divides all the processes of inflammation into hyperemia and metamorphosis of tissue. He says, in effect, in hyperemia I mean to include all the manifestations that attend it, and in metamorphosis I mean to include everything I did not include in hyperemia. I do not believe that we understand inflammation by any such limited phraseology. We must include the whole by separate phrases. Irritation is as much inflammation as suppuration, because it is one of the processes. Inflammation is not a simple condition, but a series of progressive and changing processes, going on from irritation to death; and one is just as much inflammation as the other, only we define each stage by a different term,—thus we have irritation, hyperemia, congestion, induration, suppuration, etc., each designating a particular stage in the progress of inflammation. Before there can be a lesion anywhere there must first be irritation, or an *injury*, as the English call it. That is the first stage in the inflammatory processes, or is one of the stages of inflammation. When the surgeon says there is no inflammation in a wound healing by first intention, he means that there is no suppuration, or none of the usual manifestations that follow an injury.

Healing by first intention is healing without loss of tissue. Healing by second intention is healing with loss of tissue and the reorganization of new tissue, the cicatricial tissue, to restore the loss.

DR. ABBOTT: Absolute knowledge in reference to the beginning of the formation of tumors upon the roots of teeth has not been attained, nor do I suppose it ever will be to a certainty. It is simply an opinion of mine—I do not state it as a settled fact—that they cannot

develop unless the functions of all the tissues of such teeth are in working order. In other words, if the pulp be dead in a tooth, the function of the pericementum is thereby interfered with or modified to such an extent that the growth cannot occur. Whether it can or cannot occur upon teeth where there are antagonizing teeth is another question of more or less importance. One gentleman states that he had a tooth extracted from his own mouth with an enlarged root with its antagonist intact. I have always taken the affirmative side of this question, and if I am right in my conclusions in the paper—*and this case is evidence in my favor*—that the origin is at the beginning of the formation of the cementum, then it can make no difference whether the affected tooth has an antagonist or not. Prof. Taft kindly says to me that he has a case in hand where the antagonism was perfect and there were great nodules upon the roots of a tooth taken out. Dr. Atkinson evidently owes these gentlemen something.

DR. ATKINSON: If they prove their statements.

DR. ABBOTT: I stated in my paper that one of the conditions which induced this growth was where the antagonizing tooth in the lower jaw had been taken out, and that gravitation of the upper tooth tended to irritate the periosteum to such an extent that a growth might occur if there was a systemic condition which favored the growth of such tumors. As far as this work is concerned, I wish that any of the gentlemen who have a curiosity to know anything about the labor connected with an investigation of this kind would endeavor to do something like it. The work of preparing specimens for microscopical study is not inconsiderable, I can assure you, to say nothing of the preparation of the paper.

A careful study of these sections will, I think, convince any, except those who "*know it all*," that the disease in those teeth at least commenced in an original malformation of the tissue of the cementum. Another point that should be clearly understood in reference to the growth of cement upon the roots of teeth is that no one knows when it begins nor when it ends. Whether its growth is simultaneous with the growth of the root, after the formation of the crown, or whether it follows immediately after, has never been decided, and it can only be decided by careful, earnest, and honest investigation by some person who has enthusiasm enough to go into the work and follow it up until all the facts are ascertained and established beyond a doubt.

The subject of inflammation of dentine or inflammation of any

tissue is so large, and I have already said so much about it in one way or another, that I will leave the matter where it now stands, hoping that I have done something that will induce others to go further. If I have made a statement that anyone does not believe, all I can say is, investigate for yourselves; discover my mistakes, if you can. They are undoubtedly many, and may be easy to find. Unlike some whom I might mention, I have fortunately not yet reached a state of *infallibility*.

SECTION VI.

PATHOLOGY, THERAPEUTICS, MATERIA MEDICA, AND SURGERY.

REPORT BY JOHN S. MARSHALL, SECRETARY OF THE SECTION.

SECTION VI would report that at the organization of the Section on August 4th, Dr. A. W. Harlan, of Chicago, was re-elected chairman, and Dr. John S. Marshall, of Chicago, was chosen secretary for the ensuing year. Dr. C. B. Hewitt, of Kansas City, presented a report of a case of ovarian tumor removed by Dr. Halley, in which was found a partially developed jaw, a large number of more or less perfectly formed teeth, and a mass of long hair attached to the partially developed jaw. The case is not presented to the Association for the reason that it had already been reported to another society, and published in a medical journal. The specimen, however, is of considerable interest, and may be seen by the members of the Association on applying to Dr. Hewitt.

Dr. J. Hooper, of Louisville, presented a case of osteo-sarcoma removed from the lower jaw of a young man. This also had been previously described in a medical journal, and is therefore not presented to the Association; but he has with him photographs and casts of the case which will be of interest to those of you who may take the trouble to examine them.

Dr. Hooper also reports a case of exsection of the inferior maxillary nerve for persistent facial neuralgia, and a case of necrosis of the lower jaw which he will present you.

Dr. Harlan, chairman of the Section, read a paper upon the subject of "Bacterio-Therapy," which on motion of the Section was accepted and will be presented to the Association.

The chairman of the Section was instructed to ask the Association for another appropriation of two hundred dollars for original scientific investigation. It was further decided by the Section that this money should be expended in such manner as a committee of three,

composed of the chairman and the secretary of the Section and Dr. Brophy, might direct.

On further discussion of the subject, the committee were instructed to employ some gentleman of acknowledged ability to take up the study of pyorrhea alveolaris, and to make microscopic examinations and chemical analyses of the cementum and the concretions and exudates about the roots and alveoli of the teeth affected with this disease, and also to make similar examinations and analyses of the saliva and urine of the same patients, a careful record to be kept of each and every case with the results of the examinations and analyses.

SECTION VI.—Continued.

Paper on Bacterio-Therapy.

By A. W. Harlan, Chairman.

THE Germ Theory of disease is so widely known and of such great importance that a meeting of a scientific bodywould hardly be complete in all its departments unless a paper presented dealt somewhat with micro-organisms as a factor in producing pathological conditions. In what specific manner germs operate to produce transitory, constitutional, organic, or local lesions, is not clearly understood. In many instances the claim has been advanced by investigators that a certain microbe, isolated from pus or other fluid secretion, excretion, or other point of growth, would produce, in a healthy subject, after cultivation in a sterilized nutrient medium, all the symptoms of the disease from whence the microbe was taken. It seems pretty well established that such is a fact, from analogy alone, even if we had not the results of experiments of a long line of careful and accurate investigations. While it may be doubted by some skeptics that this is true, still we have sufficient data presented to us by Miller, of Berlin, and Black, of Jacksonville, Ill., on the etiology of dental caries to substantiate the above. The labors of Pasteur in the investigation of the causes of disease in domestic animals may be cited as corroborative also. The discovery of the gonococcus in gonorrheal pus, the microbe of Asiatic cholera, the bacillus tuberculosis, bacilli of septicemia and malaria, actinomycosis in man and animals,—all tends to support the theory of the causation of disease by micro-organisms. As to the modes of causation of disease by bacteria, whether the result of their presence or of the soluble ferments secreted by them, the writer will express no positive opinion, although it is believed that bacteria by their presence do no harm other than feeding upon the tissues destroyed by the ferment secreted. Viewing bacteria and the ferments secreted by them as inimical to healthy living tissues, a ready and efficient means of destroying germs and neutralizing their products without injuring the parts to which they

are applied, must be resorted to. This may be called Bacterio-Therapy. Sir Joseph Lister, in formulating his system of antiseptic surgery, began by using carbolized dressings and the spray to destroy germs and their spores and exclude them from entrance into wounds. It was found after a time that other therapeutic agents not so toxic or objectionable to smell or irritating were equally efficient. Since the beginning of the practice of antiseptic surgery, many antiseptics and disinfectants have been proposed and used empirically in hospital and private practice. It is only recently that systematic experimentation has been undertaken to determine the relative value of antiseptics and disinfectants. Some surprising results were obtained. Many idols of the practitioners of "ye olden times" were rudely shattered, it is hoped never to be replaced on the pedestals of their practice. For the destruction of disease-germs or the neutralization of their excretions, antiseptics are not called for, except as after dressings in the care of wounds or other local lesions. This practice is believed to be indicated also in internal medication. This statement needs to be modified only in so far as a disinfectant may likewise be an antiseptic.

What are the conditions in oral surgery or the practice of dentistry calling for the use of disinfectants? Before indicating these conditions, it may appear better to define antiseptics and disinfectants. What is an antiseptic? An agent which will prevent decay. which will arrest it when once begun, in fact, preserve,—opposed to putrefaction. It need not be a disinfectant; it ought to be a microbicide. What is a disinfectant? An agent which will destroy foul odors by combining with them chemically; which will not coagulate the surface and leave the interior to putresce, but will cleanse and purify, and destroy infection. What are the conditions requiring the use of disinfectants? Before beginning an operation the hands, instruments, rubber dam, and all appliances used by the surgeon must be disinfected. Disinfectants are indicated in the treatment of engorged antra, in the roots of teeth or around them, in carious or necrosed bone, on the buccal, pharyngeal, and laryngeal mucous membrane; in fact, wherever a foul odor, infectious material, or decomposed matter is found, it is your duty to disinfect, destroy, remove, and purify. Cavities in living teeth need to be disinfected for the same reason that we disinfect a pocket in the gum, or an abscess at the apex of a root, because at these points will be found in nearly all cases a nest of germs. These minute organisms and their spores are found in teeth with and without living pulps, around the roots of the teeth,

in the antrum, on the tongue, along the whole alimentary tract, including the oral cavity, and in the air, ever ready to seek a lodgment for propagating their species. They must be destroyed. Many antiseptics will not destroy germs without causing injury to living tissues. Others will not destroy spores, hence the necessity for using sporicides, microbicides, germicides, and disinfectants. In bacterio-therapy of dental surgery such disinfectants as are least obnoxious to taste or smell and least injurious to instruments, if equally potent, are to be preferred. Those drugs which are escharotic—though disinfectant—or poisonous in small quantities must give way to remedies which are palatable and free from disagreeable fumes or stains. We now have a long list which will fulfill all these conditions. This paper deals with antiseptics and disinfectants from the standpoint of daily surgical practice, and only those remedies or drugs or methods are considered which can be utilized by the surgeon.

In choosing an antiseptic the effect sought to be obtained by its use should be the governing thought. If you wish to seal a cavity in a tooth containing a living pulp you ought not to use alcohol, permanganate of potassium, or Burnett's disinfecting liquid to moisten the pellet of cotton which you introduce, but you should use carbolic acid, aseptol, creosote, tereben, resorcin, iodol, iodoform, beta-naphthol, eugenol, pheno-resorcin, eucalyptol, sanitas oil, hydronaphthol, thymol, myrtol, menthol, boro-glyceride, or other antiseptic agents. If you wish to disinfect a foul root or its contents you would use Labarraque's solution, Condy's fluid, aqueous solution of chloride of zinc, sanitas fluid No. 1, peroxide of hydrogen, solutions of aluminium acetate or chloride, carbon disulphide, corrosive sublimate, biniodide of mercury, hypochlorite of calcium or sodium, iodine, resorcin, trichlorphenol, boracic or benzoic acid, or disinfectants which would permeate the whole mass of putrid matter and not coagulate the surface or substitute the odor of the drug for that which it was desired to disinfect. The object of chemical disinfection in dental surgery is, first to remove foul odors; second, to destroy the agents of infection and disease in the parts to which the drug is applied; after which, if it is not germicidal, apply a germicide which will destroy the germs of putrefaction; third, dress the part antiseptically; exclude floating particles of the air, the dèbris of food and saliva, and nature will do the rest. Antiseptics which are very volatile cannot be used for dressing roots of teeth or wounds of the mouth or jaws. They should not be irritating or easily absorbed into the circulation, especially if toxic. Disinfectants which are disagreeable by their

fumes, odors, or stains should be tabooed, as they are unnecessary. Bromine, silver nitrate, chlorine, and sulphur are such drugs. In order to destroy disease-germs or the germs of putrefaction it is necessary to use agents which will not only overwhelm them in their habitat, but which will prevent the development of their spores when removed from the field of observation and transferred to nutrient media. This is important, from the observed fact that some germs have been submerged in absolute alcohol, solutions of zinc chloride, five per cent. solutions of carbolic acid, and to extremes of heat and cold, and yet have lived and fructified when restored to favorable surroundings. The micrococci of pus are, for instance, destroyed by aqueous solution of sulphuric acid in proportion of one part to sixteen hundred, while bacteria require a solution four times as powerful for their destruction. Some disinfectants act by virtue of their power to precipitate organic matters, thereby destroying the aliment of certain micro-organisms, which are hence starved to death. In disinfection it must be remembered that all infectious materials are not foul-smelling. The absence of odor, therefore, is not a sure test of complete disinfection. The prevalent belief, however, is in favor of such a supposition. The mere fact of a drug substituting its own odor is not always evidence of disinfection unless experiments have so proved it. Many of the so-called commercial antiseptics and disinfectants have recently been submitted to crucial tests, and have come out in very bad shape. "In testing the various commercial disinfectants, Dr. Duggan, working with Dr. Geo. M. Sternberg, using broken-down beef tea containing spores of bacillus subtilus and bacillus anthracis, obtained the following interesting table of results:

	Per cent. in which Active.	Per cent. in which Failed.
Little's soluble phenyl	2	1
Labarraque's solution	7	5
Liquor zinci chloridi (Squibb's)	10	7
Feuchtwanger's disinfectant	10	8
Phénol sodique	15	10
Platt's chlorides	20	15
Girondin disinfectant	25	15
Williamson's sanitary fluid	25	20
Bromo-chloralum	25	20
Blackman's disinfectant	30	20
Squibb's solution of impure carbolic acid (about 2½ per cent.)	..	30
Burchardt's disinfectant	..	50
Listerine	..	50

"Disinfectants and their Use, 1885," W. O. Allison.

The relative value of the above substances is readily seen. A recent communication in the *Druggists' Circular* says: "Superheated steam, high temperatures, some of the mercury, silver, and copper salts, mineral acids, chlorine, bromine, and iodine are among the most powerful agents for destroying the infecting power of infectious material. They can destroy the spores of all microbes known to be the cause of disease. If we knew that every disease had its origin in a germ, as is now generally believed to be the case, then the words germicide, microbicide, and disinfectant would be synonymous. (Nascent oxygen or ozone should be added to the above.) * * * Experience has shown that all good germicides are good disinfectants, all good disinfectants can be used as antiseptics successfully (does not hold good), and all good antiseptics *usually* make good deodorants. The reverse, however, is not true. Substances may be deodorants and have neither antiseptic nor disinfecting power. They may be antiseptics and possess no disinfecting power. * * * * How are disinfectants tested? * * * The agent to be studied is brought into contact with the germs in definite proportions and for a definite time. If, after such germs are removed from the solution, and planted in a favorable medium, under conditions favorable to their development, they fail to show signs of vitality, it is known that the disinfectant has done its work. If, however, they still live and multiply, it is a sure sign of failure. * * In a list of fifteen reputed disinfectants (previously quoted), only one was successful in two per cent. solutions, and it failed when diluted to one part in one hundred. Listerine, French phénol sodique, Burchardt's disinfectant, and Squibb's impure carbolic acid were so poor that they failed when added undiluted to an equal portion of the test solution of germs. The rest required from seven to thirty parts in one hundred to prove successful. * * * What is the relative cash value of disinfectants?" The undermentioned table is based on the experiments of Miguel, whose first table was translated by the writer, and read at a meeting of the American Dental Association, at Niagara Falls, in August, 1883. He says: "To make ten quarts of a standard solution of equal disinfecting power we must use:

Full Cost.	Name.	No. of Grains.	Market Value.
0.00\frac{9}{10}$	Corrosive sublimate . .	100	$0.68 per lb.
.01$\frac{1}{15}$	Chlorine	375	.20 "
.01$\frac{7}{20}$	Copper sulphate . . .	1350	.08 "
.02$\frac{1}{2}$	Mercury biniodide . .	33$\frac{1}{3}$	.33 per oz.
.03$\frac{1}{5}$	Mineral acids . . .	4500	.05 per lb.
.08	Bromine	900	.60 "

Full Cost.	Name.	No. of Grains.	Market Value.
.13½	Ammonia gas	2100	.45 per lb.
.14½	Chloroform	1200	.85 "
.15	Chromic acid	300	.22 per oz.
.16½	Potassium chlorate	1950	.60 per lb.
.20	Silver iodide	50	1.70 per oz.
.20⅜	Picric acid	1950	.75 per lb.
.21⅞	Iodine	375	4.00 "
.22½	Silver nitrate	125	.80 per oz.
.30⅛	Potassium permanganate	5300	.40 per lb.
.34⅛	Carbolic acid	4800	.50 "
.56	Benzoic acid	1650	.15 per oz.
.69	Salicylic acid	1500	.20 "
4.62 9/10	Osmic acid	225	9.00 "
4.80	Thymic acid	3000	.70 "
11.00	Anhydrous prussic acid	600	8.80 "

"If we now compare the cost of the same germicide power of proprietary disinfectants, the contrast is quite startling. The following list is based upon the experiments of Sternberg, already cited. The four that failed at fifty per cent., we can for convenience assume to be potent at seventy-five. One hundred grains of corrosive sublimate, costing at pound rates only nine-tenths of a cent, is our standard of comparison. This is dissolved in ten quarts of water. The prices are those of jobbing houses:

Full Cost.	Name.	Equivalents.	Market Price.
$0.00 9/10	Corrosive sublimate	100 grs.	68 cts. per lb.
13.00	Little's sol. phenyl	20 qts.	65 cts. per qt.
35.00	50 per cent. chlor. zinc, Squibb's	100 "	35 "
35.00	Feuchtwanger's disinfectant	100 "	35 "
51.00	Phénol sodique (Hance Bros. & White)	150 "	34 "
66.00	Platt's chlorides	200 "	33 "
80.00	Girondin	250 "	32 "
80.00	Williamson's sanitary fluid	250 "	32 "
80.00	Bromo-chloralum	250 "	32 "
96.00	Blackman's disinfectant	300 "	32 "
112.50	Squibb's solution impure carbolic acid	750 "	15 "
182.50	Burchardt's disinfectant	750 "	23 "
255.00	Phénol sodique, French	750 "	34 "
495.00	Listerine	750 "	66 "

"Many of these are put up and sold in bulk. If so bought it would be necessary to reduce the figures a little. Most consumers

are compelled to buy by the bottle, and the calculation is, therefore, based upon quarts. The retail price is from thirty to forty per cent. higher than here given. These comprise the pick commercial disinfectants in the market. * * * When the best are so poor, what can we hope for from the hundreds of inferior ones palmed off upon a helpless public by ignorant charlatans, who neither know nor care what the value of their goods may be, provided they can be sold." Mr. A. Wynter Blythe, when speaking of the long array of worthless disinfectants at the London Health Exhibition, has well said: "Quackery takes a well-known common powder, labels it with a grand mystic name, selling bright copper at the price of gold."

From what has now been said you may see that real progress is being made in the warfare on disease-germs. It only remains for you in daily practice to make use of such antiseptics and disinfectants as will fulfill the definition of their respective indications. When it is stated that "seventeen pounds of the best crystals of carbolic acid would be required" to disinfect a room having a capacity of twelve cubic feet, you at once understand that it would be a dangerous atmosphere to live in. Let carbolic acid take its proper place as an antiseptic, and use for disinfection an agent non-toxic, more potent, and less costly. Do not deceive yourselves by thinking that an agreeable perfume which masks a foul smell will prevent further decomposition, nor that the widely diffused odor of a drug heretofore believed to be a disinfectant will destroy micro-organisms or other infectious effluvia. It is *not* necessary to use antiseptics or disinfectants in the mouth or on the teeth which will be injurious to them or the mucous membrane. Therefore, acid disinfectants which are valuable for sanitary purposes are not to be commended for disinfection of wounds, dressing roots of teeth, or for use on mucous membranes. *

* A portion of this paper appeared in the transactions of the Illinois State Dental Society for 1886.

SECTION VI.—Continued.

Reports of Surgical Cases.

By J. HOOPER, of the Section.

CASE I. On the 18th of June, 1885, Dr. W. O. Roberts, an eminent surgeon, called to see if I would assist in an operation for the exsection of the inferior dental nerve.

I consented, and we decided to perform the operation on the 22d day of June, when it was conducted, after the administration of chloroform, by Dr. Roberts, cutting through and exposing the bone from the mental foramen to the angle.

I then with a fissure-bur, commencing at the mental foramen, cut down to the nerve-canal, until the nerve was freely exposed. As the bur became clogged with blood and bone, it was cleaned with the file-brush, while our assistant sponged the blood away. After the nerve was freely uncovered it was pulled out with a hook and two and a half inches cut off, as you see it in this phial of alcohol.

The wound was dressed with horse-hair drainage, and in ten days the patient was able to leave for her home in the country, and has since suffered no pain.

Here are some photographs taken a year after the operation. You can see what a small cicatrix there is, as I have both side and front views.

History of the Case.—Mrs. Neighbors, fifty-four (54) years of age suffered with what she supposed was neuralgia, and at different intervals had her teeth extracted until all were taken out, but the pain returned and was very severe. She would send for her physician and often the pain would leave before he reached her, but would soon return and finally got to be constant, even liquid food causing intense pain. It was finally decided that the only chance of relief would be from the exsection of the inferior dental nerve.

She has had perfect health since the operation and has suffered no

pain, the only inconvenience she experiences being a slight numbness of the chin, with a tingling sensation.

Case II. This piece of necrosed bone I removed from the left inferior maxillary of a boy twelve years of age. The trouble originated in an abscessed tooth which was improperly treated and extracted. The abscess came through the outside, and was treated for nine months by a physician, who proposed to chloroform the patient and scrape or cut away the diseased bone, but his parents objecting to chloroform or ether brought him to me to see what could be done for him. I treated him a few days until the inflammation was reduced, and then saturated a piece of cotton with a four per cent. solution of cocaïne and placed it in the fistulous opening and let it remain ten minutes. I then repeated this treatment, after which I cut in and took out this piece of diseased bone with some smaller loose pieces. He seemed to suffer no pain and the wound healed in a few days.

Case III. Here is a cast of a lady's mouth with an enlargement of eighteen months' standing. Several physicians had treated her, and it had been lanced several times, but did not go away. I think the impression was made that it was a cancer and she was sent to a surgeon to be operated on. He saw it was an abscess and lanced it and then telephoned me to ask if teeth would produce such trouble. I answered yes. He then brought her to my office. My diagnosis was a dead pulp in right central incisor. I questioned the patient, asking her if she had ever suffered with toothache. She answered that she had not. I then asked her if she had ever received a blow or fall. She at first answered no, but after thinking awhile said that she had once fallen down stairs, but several years had passed since then.

I drilled through to the pulp-canal and found a very offensive, thin, watery pus. The case yielded very readily to treatment, and in four or five days she said she felt like a new person. She had suffered very much with headache, had a fullness in the face, and was hard of hearing. In this time the headache had left entirely, also the swelling of the face, and her hearing was very much improved.

DISCUSSION.

Dr. McMillen. The skull which I hand around shows what is thought to have been a case of congenital anchylosis of the jaw on the right side. The skull was that of a negro, who was killed at the age of forty years, by being thrown from a window. He was of

intemperate habits, and was intoxicated at the time he was killed. The autopsy revealed the condition shown. The osseous union, as you see, was complete. The trouble is supposed to have been congenital, as when the subject was first observed by medical men, at the time he was about five years old, the immobility of this side of the jaw was absolute. He took nourishment, principally liquid, through the opening made by a missing front tooth.

DR. ATKINSON: Did I understand that the hair found in the ovarian tumor mentioned in the report grew directly from the jaw-bone?

DR. MARSHALL: It should, perhaps, have been stated more clearly. There was a partial development of the upper maxillary with skin covering it, and from that the hair grew.

DR. ATKINSON: There is nothing wonderful in that; but I could not understand how the hair follicles could develop directly from the jaw-bone, as I understood the statement.

SECTION VII.

PHYSIOLOGY AND ETIOLOGY.

Litmus Tests of Oral Fluids with Chart for Recording Observations.

PAPER BY W. STORER HOW, OF THE SECTION.

BRIEFLY stated, it is the present purpose to initiate and cultivate the habit of making tests to determine the acidity, alkalinity, or neutrality of the contents of the mouth at different times, and under varying conditions, in order that such recorded tests may be collected, collated, and tabulated to an extent which shall prove of practical value to the dentist, in pointing him to the cause, the character of, and the cure for the dental lesions he may be called to consider.

In the light of tabulated and verified information of this kind, it will become the first duty of the educated practitioner, on the advent of a patient, to make and record these oral tests, so that by comparison with the statistical record he may be enabled to decide with a degree of scientific precision what remedial measures are requisite for the case in hand; or, if a series of tests shall be a pre-requisite for the proper determination of the question, then these will be made in the way and at the times proved to be reliable and indicative by the method under which the previous data have been collected.

As a hint of what may reasonably be expected, it is probably safe to predict that the choice of a suitable filling-material for cavities caused by dental caries will finally be fixed by positive information as to the acidity or alkalinity or neutrality of the immediately related parts, and of the adventitious matter liable to association therewith.

Entirely new filling-materials may be devised when once the

elements of the problems to be solved are brought within the province of exact knowledge.

New and delicate reagents will doubtless be discovered under the stimulus of a quickened desire for sensitive and accurate tests.

Beyond question it will be found to be of advantage to encourage and develop a habit of careful and thoughtful preliminary observation and record relative to the condition of the mouth and teeth in every case presented, and in that belief this confessedly imperfect and incomplete chart is introduced, with the hope that further study and experiment will lead to the general adoption of a complete and uniform system by means of which a great advance will be made in the scientific theory and practice of dental surgery.

The blank form or chart now submitted provides for the recording of observations and tests by the Hillischer system of notation. It will probably prove desirable to have the charts in book form when the details shall have been perfected.

A condensed description of the method of procedure is printed in the chart, and is clearly exemplified by the printed sample record.

LITMUS TESTS OF ORAL FLUIDS.

Made by.....*Ernest Investigator, D.D.S.*.....

Address.....*Newfoundland, N. W.*,..... .....*August 3d*,.....188..*6*..

Serial No.....*9*..... **Name**.....*M. N. O.*,.....

Age.....*18*.....**years.** **Male.** Female. **Robust.** Healthy. **Feeble.** **Ill.**

Pyorrhea..... **Scorbutus**..... **Calculus**..... **Ptyalism**.....

Parotid Saliva.....L A **Sub-Maxillary Saliva** I A **Sub-Lingual Saliva**.. I A

Teeth . . . **Brown-yellow.** Cream-yellow. **Pearl-blue.** **Pallid or Muddy.**

a.——Artificial substitute, or plate of any kind.
b.——Buccal position.
c.——Coronal position.
d.——Distal position.
e.——Eroded surface.
f.——Filling, of any material.
i.——Irregular position or shape.
l.——Labial position.
m.——Mesial Position.
o.——Opening, or cavity.
p.——Palatal or Lingual position.
pp.——Pulp.
r.——Root.
s.——Supernumerary.
t.——Treated.
u.——Ulcerated.
x.——Extracted.

A——Alkaline.
A——Acid.
N——Neutral.
I——Slightly Alkaline, or Acid.
L——Obviously Alkaline, or Acid.
U——Decidedly Alkaline, or Acid.
O——Excessively Alkaline, or Acid.

			o b L A					*o pp* L A							
8·	,7·	,6·	,5·	,4·	,3·	,2·	,1·	·1	,·2	,·3	,·4	,·5	·6	,·7	,·8
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			o c L . A.					*o c* I A							
Deciduous.			7:	,6:	,3:	,2:	,1:	:1	,:2	,:8	,:6	,:7			
			7:	,6:	,8:	,2:	,1:	:1	,:2	,:3	,:6	,:7			

Time after eating.....*2*.....**hours.** **Food last eaten**.....*Fruit*.....

Food taken from between.....*six*.....**teeth, test shows**.....U A .....

First take with the foil-pliers a piece of blue litmus, wet it with Parotid Saliva and put the wet piece on a leaf from a foil book. In like manner treat the Sub-max. Saliva, placing the wet piece on the leaf below the other. Thus also test between the teeth, in carious cavities, pulp-cavities, roots, sulci, pus-pockets, under calculi, plates, and bridges, etc. Make the same tests in the same order with red litmus. Fill up the blank with the other statistics, and then note and record either the unchanged color of both the blue and the red by the symbol N neutral, or the change of the blue to red by the symbol A Acid; or the change of the red to blue by the symbol Alkaline, as the case may be. Mark the indicating symbols by the Hillischer Notation, for by its use every particular may be quickly and clearly recorded.

SECTION VII.—Continued.

Protoplasmic Nutrition and Molecular Metamorphosis in the Dental Tissues.

PAPER BY ALTON HOWARD THOMPSON, OF THE SECTION.

ALL life is evolved by and in the embryonic protoplasm,—or bioplasson or sarcode,—which, in its primitive simplicity, is the basis and matrix of all animal tissues. It is that element in all the tissues which, from its first proliferation, conveys nutrition, guides development, directs tissue-building, presides over typal evolution, and after completion of the tissue maintains the integrity of its form and quality, and carries nutriment into it and waste from it to the capillaries.

But protoplasm appears in its primitive purity in very few, if any, completed animal tissues. The complexity of organization of these various tissues is infinite, and is due to the extraneous elements, organic and inorganic, which are deposited and arranged after definite typal forms within the meshes of this primeval element of all the tissues. The embryo during its earliest stages is apparently composed of protoplasm in its simplest combinations; yet it is impressed with mysterious powers of differentiation into specified organs from the fecundated ovum, in accordance with and in obedience to typal impulse. This impulse, inherent in the ovum and spermatozoa, is the great impenetrable mystery of life. Why all the forms of all the tissues in all their multifarious qualities and compositions should assume special shapes and characteristics and powers under the impulses conveyed by the minute cells which are the foundation of the organism, we cannot understand, unless, indeed we fall back upon the interference of a supernatural power above and beyond our ken.

In the evolution of the organism the protoplasmic compounds, which are first proliferated as the basis structure, select from the stream of nutrient pabulum flowing through it from the capillaries the particular elements which may be necessary for the elaboration of each tissue; each protoplasmic molecule of each tissue working under its own differentiated impulse, whether it be building bone or nerve tissue, muscle, or tooth enamel. The protoplasm then remains as a permanent element of each tissue, and gives it life; it carries in the nutriment and takes out the waste. The superior, the complex elements of the tissue are therefore dependent upon the vitalizing protoplasm, not only for creation, but for subsequent support and maintenance. The complex elements make each special tissue what it is, that it may perform its allotted work in the economy of the organism. But when the vivifying protoplasm perishes, the other elements quickly die, for through it they live and move and have their being, and perform their appointed duties.

All animal tissues which lose their protoplasm through any process of evolution or exfoliation—such as the epithelial structures—become isolated and are dead. They are attached to the organism, but have no life and exist unaltered if totally separated from it. It is still a moot question whether the enamel, being an epithelial though calcified tissue, should be classified with the vital or the exfoliated products. That it is totally devoid of life throughout its substance we cannot believe, nor yet that it is vital to its periphery. Perhaps a middle ground would be most nearly the truth. That it is vital is proved by the organic areas of protoplasmic elements which have been demonstrated to exist in it when the life of the pulp is maintained; but when this organ perishes the enamel becomes as dead as hair or hoof cut off from nourishing elements.

In applying these observations concerning protoplasm to a study of the teeth, we find that, like other tissues, the dentine and enamel have each been developed from a specially modified protoplasmic matrix, which in its earliest form is nearly pure albumen. With the mysterious impulse imparted to the formative pulps, they intelligently select from the pabulum the organic and inorganic elements required for the proper construction of these tissues, which are so wonderfully elaborated in all their details in accordance with typal commands.

Dentine seems to be much the same tissue as bone in regard to its chemical elements, but is very different in its morphology. It is formed in a protoplasmic matrix of excessive vascularity by the re-

duction of the supplied lime-salts in globules formed in successive capsules, which are pierced by the fibrils, around which permanent tubuli are formed. Spaces are sometimes isolated by the aggregation of globules, and in these there is often nothing but protoplasmic elements, but as a rule these interglobular spaces are filled solid by calcification. This form of calcific globules can be imitated experimentally by precipitating lime carbonate in any viscous fluid, but especially in fluid albumen, which comes nearest to the animal matrix. On the periphery of the dentine we find irregular granulations and spaces also, as the foundation for the more regular forms of precipitation. Throughout the whole tissue the protoplasmic elements persist as the living organic matrix which, by connection with the mains, the contents of the tubuli of the dentine, the fibrillæ, which are in their turn the persistent protoplasm, conveys nutrition into the tissue and waste from it, and incidentally conveys sensation to the pulp.

The enamel is formed in a manner analogous to that of dentine but yet dissimilar in detail, as the tissues are dissimilar in chemical composition as well as in morphology. Enamel is a calcified epithelium, or at least it is formed in a protoplasmic sub-basis, which is the result of a metamorphosis of epithelium. This basis is embryonic protoplasm, and within its substance is formed the tissue which is to be the inclosing capsule of the crown of the tooth when thrust beyond the gums. The salts of lime are deposited and arranged in a specified manner, according to the transmitted impulse, and in an organic matrix of horny matter,—*keratine.* It appears that there are areas of living-matter throughout this tissue,—perhaps, indeed, a reticulum of protoplasm penetrating the substance of the prisms themselves,—but at least so far as it is living-matter it contains protoplasm, and this conveys nutrition. Through this the enamel is nourished, however limited and minute this and the corresponding removal of waste may be; the main fact being that nutrition and waste are exchanged within the tissue to some extent by means of the connection of the living-matter of the dentine with the periphery of this tissue.

The power by which the movement of fluids in the protoplasm of the tissues is maintained is the function of osmosis, inherent in protoplasm. Upon this depends the flow of the fluids which create and continue life in all animal organisms,—even that highest elaboration of protoplasm called man. For, after all, animal forms are but modified sponges, which draw fluids through the meshes of their

tissues to strain out the nutritive matters contained therein and, casting their waste products into the stream, pass it onward.

It is through this faculty of osmosis inherent in all tissues that continuous currents are maintained. The well-known example of an animal diaphragm separating two dissimilar fluids which commingle more or less through this membrane illustrates this. The membrane by a power all its own, a capillary affinity, draws the fluid within itself. That is called *end*osmosis. Then by another action—repulsion—it sends the fluid onward and outward—expels it. That is *ex*osmosis. If now we carry this conception to the living membranes and tissues within the body, we will observe that they too possess this power of osmosis; that they absorb fluids—pabulum—from the capillaries by an attraction,—an affinity,—and then expel them by a repulsion equally strong, thus maintaining the currents. The change of polarity of the fluid must take place within the tissue to account for the sudden switching from attraction to repulsion.

Probably the hunger of the tissue for food causes it to draw the pabulum, and having absorbed the nutriment it craved and thrown the waste into the current, the fluid becomes offensive, and it is expelled with equal force, thus maintaining a vacuum and acting with the precision of the positive and negative poles of the magnet. This power of attraction and repulsion must vary with the vitality and density of tissues, of course. Thus, the nervous substance being more vital and vascular would require and attract more nutriment and throw out more waste, and we find this to be a physiological fact; and bone being less vital and more dense in structure would attract less nutrition and throw out less waste. By the power of osmosis we believe that the circulation of the blood and other fluids of the body is aided and accelerated, and that the attraction and repulsion so exercised on the blood by the tissues is the missing link in the chain of causes inducing the movement of the blood in its circuit.

We cannot but conclude that this function is present in all tissues; that it is one of the inherent properties of protoplasm and of all its compounds. We know, indeed, that all tissues are nourished by the circulation; we know that they throw their effete matter into the veins to be carried off; we know that all compounds of protoplasm possess the power of osmosis in both directions; we know that protoplasm is the basis of all tissue, and hence conclude that this element has most, if not all, to do with the osmotic nutrition of the tissues.

And so, as there is living-matter within the tissues of the teeth, and this living-matter must be protoplasm or its simple protean compounds, we cannot but assume that the dental tissues are nourished by the ever-present and ever-acting powers of osmosis. We know that osmosis, of course, begins at the capillary walls, the limit of the red blood-corpuscle's excursions, and that the pabulum is carried by that power to the innermost parts of the tissues, and that waste is carried back to the capillaries and there thrown into the veins, the sewage system of the economy. We know also that this osmotic circulation is maintained within the bones, by which the currents flow through the protean contents of the lacunæ and canaliculi, and the bone thereby nourished and molecular changes effected even in its calcific substance. We know also that this circulation is maintained in the fibrillæ of the dentinal tubuli, and that life is thereby sustained in the dentine. As the tubuli anastomose with the canaliculi of the cementum at the periphery of the dentine, and the circulation is continuous between the two tissues, we depend upon this circulation for the maintenance of life sufficient for the toleration of the tooth by the living tissues about it after the removal of the life-source of the dentine, the pulp. We expect it to preserve not only the life of the cementum intact, but also to maintain some vitality in the dentine in contact with it.

But further than this, it has been conclusively demonstrated that there are areas of living-matter in the enamel, and that this living-matter is in direct connection by an anastomosis more or less regular and continuous with the contents of the dentinal tubuli. If this be true, then indeed there is osmosis by which nutrition is conveyed to the enamel, however minute and inappreciable it may be.

If this circulation exists by the inherent powers of osmosis in the protoplasm or protean organic elements of the dental tissues, then we must hold that molecular change is possible within limits that could make such change appreciable. If the tissues can be fed and their waste products carried off by this osmosis, then must molecular change be possible in the dental tissues as in other tissues, through physiological variations within health-limits; but especially in favorable pathological conditions of the circulating fluids would these tissues be subject to alterations.

A few of the ordinary evidences of this alteration might be cited in illustration. First, it is well known that the teeth at eruption are not so dense in structure, so rich in inorganic elements, as at maturity. Again, this density usually increases with age and active

employment, so that the dentine of old age and the dentine of adolescence are very different in quality. The former is nearly devoid of protoplasm, and the very fibrils become calcified to some extent, and often the pulp itself; while the latter, though morphologically perfect, is very incomplete chemically, and possesses a large quantity of mere protoplasm, which will need to be calcified before the dental tissues will reach their mature texture.

And if this calcification can take place after the tooth is erupted and morphologically complete, we must believe from analogy that the polarity can be reversed and *de*-calcification be possible under the incitement of pathological conditions. Even physiological change of the circulating fluids, such, for instance, as occurs in pregnancy, induced perhaps by lime-starvation, may cause molecular change, for we have reasons for believing that lime is taken from the teeth and bones for the construction of the osseous system of the fetus, and that it is returned after this function is completed. Indeed, the molecular disturbance of the entire system is very great and very appreciable, physiological activity everywhere being accelerated during the continuance of the creative function. And after this, during lactation, there is also disturbance of a somewhat different kind, a lactic prevalence and a draining of the system of its general food stores when the required lactic elements are not supplied by the digestive and assimilative powers in sufficient quantity to meet the excessive demand. In both conditions a molecular breaking down occurs, and the resulting food is appropriated by the growing child.

Again, we know that the teeth of patients which have been in good, dense condition for years, requiring very little treatment at our hands, will suddenly and often without apparent cause take on a condition of unaccountable softening, and caries will progress with uncontrollable rapidity. What it is that causes this remarkable change, what it is that acts through the circulating fluids to disintegrate and carry off the lime-salts, we do not know. But it is a molecular change of some sort,—a retrograde metamorphosis which simulates a return to the embryonic condition,—a breaking up of molecules for *re*-formation of elements which may have a destiny as food to other parts of the system, or it may be to form purely waste products.

Molecular metamorphosis is at once the wonder and the mystery of modern physiology. Recent investigators have completely revolutionized our ideas of even such simple things as the digestion and assimilation of foods. "The older physiologists assumed that the

flesh of the meal was directly, without great effort, and without much change, so far as the chemical composition is concerned, transformed into the muscle of the eater. The researches of modern times, however, go to show that the substances taken as food undergo many changes and suffer profound disruption before they actually become part and parcel of the living body, and conversely, that the constructive powers of the animal body were grossly underrated by the earlier investigators. If we were to put forward the claim that the proteid of the meal becomes reduced almost to its elements before it undergoes synthesis into the superficially similar proteid of muscle, the energy set free in the *de*struction being utilized in the subsequent work of *con*struction, we would not anticipate modern research but a brief time, for it would almost seem as if the qualities of each particle of living protoplasm were of such individual character that it had to be built up fresh almost from the very beginning. The problems of physiology in the future will be largely concerned in arriving, by experiment and inference,—by the mind's eye and not by the body's eye alone,—at a knowledge of the molecular construction of this protean protoplasm, of the laws according to which it is built up, and those by which it breaks down; for these laws when ascertained will clear up the mysteries of the protean work which the protoplasm does. All over the body the protoplasm is constantly building itself up out of the pabulum supplied by food, and continually breaking down, giving rise to different tissues and combinations in different parts of the body, with different compositions and different properties, the various activities of the body being the outcome of the various properties of the various combinations. If this be true, it inevitably follows that protoplasm cannot be the same everywhere, but that there must be many varieties of protoplasm with different qualities, and with correspondingly different molecular structure and composition." (Michael Foster.)

But as to this molecular metamorphosis in the substance of the tissues,—both constructive and destructive, progressive and retrogressive,—we cannot yet witness its methods, but only its phenomena. "We are taught by physiologists that there is a constant splitting up of the molecules of which the body is composed. This breaking up is accompanied in health by corresponding building up of tissues from the food after assimilation. For instance, the bones lose their phosphate of lime to which they owe their solidity, the salt passes into the blood, and is there eliminated by the kidneys.

The brain also loses phosphorus. Now, the food should, if appropriate and duly assimilated, supply an abundance of the phosphates, —ample, indeed, to bear the strain imposed upon the phosphorus resources of the body. But this supply being insufficient, or digestion or assimilation being imperfect as regards the phosphorus salts, a phosphorus famine begins and the body feeds upon itself and consumes its own phosphorus. So a general malnutrition may react upon any specified parts of the organism by abducting its constituent salts, albumen, or other matters, and thereby lessen its resistive power to disease; and the teeth are organs peculiarly liable to suffer from this general malnutrition, inducing a chronic starvation, and by lowering their vitality and robbing them of much of this reserve store of materials render them more liable to caries." (Ed. *British Jour. of Dental Science.*)

Molecular metamorphosis is the cause of every act and process of nutrition and removal of waste. Indeed, it is certain that a "wasting of its tissues" *is* wasting,—a removal of integral parts by molecular breaking down, but the expected replacement does not follow. In certain diseases assimilation and molecular construction seem to be held in abeyance, while breaking down and waste still go on, either normal or abnormal, and in other conditions again waste is lessened and construction goes on, with corresponding increase in the quantity or density of the tissue. These operations we observe in the dentine, and perhaps they take place in the enamel. As there is nutrition and waste by osmotic currents in these tissues, there must be molecular change in accordance with general law. The teeth cannot be exceptions to a rule among vital tissues in this regard There can be waste of the inorganic elements of the dentine and probably of the enamel, and when this removal is not followed by compensating reconstruction of lime phosphate molecules, softening of these tissues results, with corresponding lessening of resistance to the attacks of caries. Then, again, there may be increase of density, as transpires with age, by a more rapid construction than waste. If molecular progression and retrogression are continuous in normality, then is metamorphosis omnipresent in the dental as in all other tissues.

ADDENDA.

In the condition known as inflammation in the dentine, we have a molecular activity which seems to be a breaking down and removal of lime-salts, then of its organic matrix, and then in healing

a reconstruction of both occurs. "Inflammation causes solution of the lime-salts, and afterwards a liquefaction of basis-substance, both in bone and dentinal substance. The result will be the appearance of globular spaces, a bay-like excavation, which, instead of being filled with basis-substance, exhibits medullary corpuscles, multinuclear protoplasmic masses, corresponding to the embryonal stage of the tissue . . . Suppuration may result, but far more common is the healing process of eburnitis, the results of which may be seen in the formation of dentine closely resembling secondary dentine, or a dentine destitute of canaliculi,—osteo-dentine." (Heitzmann and Bödecker.) What this inflammatory condition is we will not stop to consider, but it will suffice for our purpose to direct attention to the intense molecular activity that takes place, the breaking down and then total removal first of organic and then of inorganic elements, and then the following of molecular synthesis, by which the basis-substance, as well as the calcified elements, is reproduced again. Here is a molecular work which cannot for a moment be doubted, and, while we observe its operations with wonder, we cannot but regret that the mystery of its *modus operandi* is yet impenetrable.

SECTION VII.—Continued.

Surgical Diseases of the Tongue.

PAPER BY H. A. SMITH, OF THE SECTION.

ALL along down from the first records of medicine the appearances of the tongue have been studied in connection with morbid conditions of the system. This organ being brought to the view of the dentist in his operations on the teeth, its appearance in health and disease, if properly studied, would often enable us to advise our patients as to whether the peculiar appearances presented are due to local conditions present in the mouth or to sympathy with the alimentary canal, or perhaps with other parts of the system.

But it is not with the medical aspect of the subject that it is our purpose to deal, but rather with the surgical diseases of the tongue.

The tongue, situated as it is in the floor of the mouth, is surrounded by the teeth. These, if healthy and intact, form a protecting wall to shield it from harm, but if diseased or broken down they become the veritable cause of a variety of diseases of the tongue; and when the tongue is subject to organic disease, it in turn becomes an offense to the teeth and may cause their destruction.

In this connection we may mention *parasitic affections* of the tongue. While animal parasites are rarely found on the tongue, it may safely be said that no tongue, however healthy, is free from *vegetable* parasites; and yet Butlin states that there is but one disease, so far as he knows, due to the presence of a vegetable parasite, namely *thrush*, a membranous disease not only of the tongue, but of the inside of the mouth generally. The disease depends upon the presence of a fungus (*oidium albicans*), which is identical with the oidium lactis, the ferment of the acid fermentation of milk.

These two parasites being morphologically alike, we should expect to find in the mouths of children who are attacked with thrush

after the teeth begin to erupt that caries would be more prevalent with those who are fed with a spoon than those fed with mother's milk. In children artificially fed the mouth shows more constantly an acid reaction. In the act of sucking the saliva is secreted in larger quantities, and being alkaline, the acidity of the fluids of the mouth is neutralized to a degree not found in children fed with a spoon.

The condition called *furred tongue* was formerly regarded as nearly always a sign of disease; variation in the extent and color of the coating indicating the particular form of disease.

Greater weight must be given these appearances in diagnosis of disease if we consider this deposit of fur as proceeding from a secretory process of the tongue itself (Wood) than when we accept the modern view that fur on the dorsum of the tongue, whether in health or disease, is essentially a growth of fungus (chiefly of micrococcus and bacillus subtilus), and that the epithelium and food débris usually present are unimportant and accidental constituents (Butlin).

The vegetable spores found in the fur are deposited in the filiform papillæ of the tongue from the food taken in the mouth, as well as from the inspired air, and finding a favorable habitat the germ grows with surprising rapidity, especially at night when the tongue is comparatively still.

We have frequently noticed a considerable layer of fur on the tongues of patients for whom we have operated during the first morning hour, and have seen it rapidly disappear from the agitation of the saliva, frequent rinsings of the mouth, and motions of the tongue induced by our operations on the teeth.

Frequently the tongue is prevented from being cleansed in the natural way by the absence of one or more teeth on the side of the mouth, by the roughened surface of a tooth, or the presence of diseased teeth that are sore to the touch, thus preventing sufficient movement and friction against the teeth to cleanse the tongue. If a person eats on one side of the mouth, the tongue on the opposite side will show more or less furring. Mr. Hilton attributes this furring of the tongue to disturbance of function and nutrition by reflex action through the influence of the fifth nerve. But, as Mr. Hutchinson remarks, most of these examples of unilateral furring may be explained by mechanical action.

The tongue is subject to quite a variety of ulcers. Of the traumatic variety, those that are caused by the teeth wounding or irritating the tongue frequently come under the care of the dentist. Unless the patient is subject to chronic glossitis, these simple ulcers

are speedily cured by removal of the cause of the disturbance, a very simple operation frequently, as by carefully smoothing the jagged edge of the tooth or by extraction. If the ulcers are caused by badly-fitting artificial teeth, the substitution of a better set will generally cure the trouble.

Ulcers which form on the under side of the tongues of children attacked by whooping-cough, and which are supposed to be a specific lesion of the disease, may be, we think, explained by the irritation caused by the rubbing of the tongue against the lower teeth during the paroxysms of coughing.

A recent writer in the *American Journal of the Medical Sciences* says the action of amalgam fillings when coming in contact with the tongue may cause a whitish aphthous patch from epithelial thickening and erosion. Most likely this appearance is brought about by roughness of the filling or margin of the cavity acting as a mechanical irritant upon the surface in contact with the filling.

Aphthous ulcers are frequently met with upon the tongue and mucous membrane of the mouths of adults, but they are more common in children; and it is still a moot question whether or not the disease is contagious. If a specific parasite is always present in aphthous ulceration, then it is possible for a dentist, unless proper antiseptic precautions are observed, to convey the pathogenic germ from an aphthous patient for whom he has operated to the mouth of another susceptible patient.

Cancer of the Tongue.

Among the exciting causes of *cancer* of the tongue usually mentioned by writers are bad teeth, ill-fitting plates; coarse, hot, and highly spiced food; the constant friction of the mouth-piece in using a tobacco pipe, chewing tobacco, and the injudicious use of caustics in treating sores on the tongue (Butlin).

The relation of the disease to age and sex is somewhat striking. Statistics show that it is hardly known in young adult life, while it is quite common between the ages of 40 and 70.

We have mentioned the irritation caused by jagged edges and rough surfaces of the teeth as a cause of cancer of the tongue, and it may be noted in this connection that the teeth during the period of life between 40 and 70, if neglected, are most likely to take on the conditions tending to injure the tongue. To the hard usage and greater neglect to which the teeth of men are subjected, we may, in part, attribute the marked frequency of carcinoma in males over

females. Baker, who gives a record of 293 cases, states that of these only 46 were females.

Another explanation of this difference in the liability of the two sexes to cancer of the tongue is that women are not given to drinking, smoking, and chewing, as are men.

Carcinoma may attack any part of the tongue; but the fact that it is most frequently seated in the parts in contact with the teeth, emphasizes the importance of giving attention to these organs in diagnosis and prognosis of this disease. The following table, taken from Butlin, shows the parts of the tongue in which cancer is most frequently seated:

Of 80 cases he finds in the

Root	1
Anterior half and top	8
Right border	12
Left border	17
Left side	16
Right side	11
Border	1
Dorsum	15
Right underside	2
Left underside	1
Whole tongue	1
Total	80

Here we have, out of 80 cases, 30 situated in the border of the tongue; and of the 27 seated on the side, it is probable that most of these were upon the border also, and that a closer analysis of these cases would show that the anterior half of the border is much more likely to be affected than is the posterior half.

This plainly shows that the teeth, when neglected in middle life, instead of affording a protection to the tongue as intended by nature, are frequently the cause of a disease the usual prognosis of which is death.

The question whether or not the habit of smoking predisposes to cancer of the tongue is now frequently asked. Butlin says: "There is no evidence with which I am acquainted which will prove that carcinoma is really much more common among adult males who smoke than adult males who do not smoke." Yet I think it not improbable that smoking does to a certain extent predispose to the disease.

The same author remarks that it is not often that chewing tobacco can be credited with producing carcinoma, yet he mentions a case in which "carcinoma appeared on the part of the tongue where the quid of tobacco habitually rested." If the tongue was first made sore by a roughened tooth, the irritation would be kept up by the mechanical effect of the quid of tobacco in contact, and carcinoma would eventually result.

Diagnosis of lingual cancer is rendered quite difficult, because of the resemblance of syphilitic ulcerations, of tubercular ulcerations, of fissures of the tongue, and sometimes of simple ulcers, to carcinoma; and moreover, the difficulty is increased by the fact that certain of these diseases are transformed into carcinoma by almost imperceptible gradations.

In all doubtful cases the microscope is the most valuable and reliable aid to diagnosis.

As dentists, our attention is frequently directed to the pre-cancerous conditions of the tongue. If a lesion of the tongue is discovered, every possible source of irritation should be searched for, and as carefully removed. And since the most common of these sources of irritation are associated with the teeth, the dentist, by recognizing the pre-cancerous condition of the tongue and removing the cause of the irritation, may prevent a simple ulcer of the tongue from developing into carcinoma.

SECTION VII.—Continued.

Pathological Heredity and Gouty Teeth.

PAPER BY ALTON HOWARD THOMPSON, OF THE SECTION.

THE deleterious influence of hereditary diseases and of transmitted predisposition to certain diseases upon the development of the teeth is now one of the well-recognized facts of dental embryology. They induce disturbances of function in relation to the development of the teeth, which are strictly pathological, and which eventuate in defects and deformities of these organs which are more or less pathognomonic; but as to *how* this is effected we are yet in the dark. It may be by perverting the nutritive fluid, either by filling the pabulum with the poison of the disease or the diseased products, or merely by causing insufficiency or poverty of tooth-forming materials in the fluids; or it may be by affecting the formative organ itself, causing the death or disruption of the building cells, which gives rise to defective areas; or again, by affecting the whole organ and causing the whole crown to be imperfect or malformed.

Some observers believe that defective enamel is caused by acrid fluids acting upon it during the process of eruption, and not by defective formation of the tissue, but the evidence is yet upon the side of the congenital and follicular effects of disease, and that teeth are unaltered after formation, as regards their form at least. As Magitot says, "If the alteration were chemical in its nature there would be no change in the center of the organ, but this is always present. * * * Congenital lesions of the teeth, fissures, erosion, etc., are exclusively due to disturbances of dentinification, and belong to the history of the follicular evolution."

Indeed, the study of the pathology of dental embryology is now largely concerned with the observation of transmittible diseases, which, directly or indirectly, injuriously affect the growing tooth-germs. Of course, many of the acute diseases incident to infancy, especially the exanthemata and intestinal affections, leave a legacy

of markings and defectiveness which are well known to emanate from these disturbances; but as compared with hereditary influences in causing weakness in structure and deficiency in form, the latter are the most constant and powerful.

When we contemplate the whole field of pathological heredity,—of diseases directly transmitted, of predisposition to disease as well, of defective organs inherited, of weakness, debility, and enervation in all its forms, that are so prevalent and transmittible, we cannot wonder that the teeth are so often defective, but rather that they are ever perfect; for perfect physical health, in this day of the preservation and propagation of the unfit, is as rare as it is desirable.

Most transmissible diseases affect the tooth-germs—or other organs and tissues—in a particular way, so that characteristic effects are produced in the growing tooth which remain as a more or less permanent pathognomonic sign of the disease. Some of these signs—syphilitic notably—we are able to recognize, and the markings have a positive diagnostic value to the pathologist. Gout can be placed in this category also, and some other diseases, such as rachitis, scrofula, scorbutis, and tubercle, are being approached; but knowledge of the signs of these diseases is not yet perfect. There are others also which affect the development of the teeth, of which we know little but suspect much. And as the field broadens by judicious observation, our knowledge will be wonderfully developed, for there are likely yet other influences which may have a positive effect which we do not now suspect.

Here we would urge upon dental and oral specialists, especially those having access to hospital work and all institutions where persons are collected in numbers, the desirability of making observations and records regarding the effects of all diseases upon the development of the teeth; for only by systematic observation and extensive statistics can we arrive at a just solution of this problem.

Gout is a disease which is not endemic in the United States, and only appears here when imported directly from the mother country, England. Errors in diet are punished by nature in other ways among this great people—the related disease, rheumatism, being one of the most efficient instruments for that purpose. We Americans suffer for our indiscretions, but not as our Anglo-Saxon ancestors did; so that we are prone to admit that the study of gout and gouty teeth has little practical value to us. The scientific interest in the question is great, however, for we have progressed so far in the investigation of gouty teeth as to place them in the same category

with syphilitic teeth, as having a positive diagnostic value in determining the presence of hereditary gout.

That we may definitely understand the nature of the disease, let us glean from the authorities upon the subject such items as will enable us to intelligently consider it:

Quain defines gout as a "general or constitutional disease, probably depending upon the presence in the system of excess of uric acid, the complaint being, in fact, a manifestation of the lithic or uric acid diathesis. It may be hereditary or acquired, and is characterized ordinarily by a peculiar inflammation of the joints—*articular* or regular gout, attended with the deposit of urates in their structures, affecting usually and especially the smaller joints, beginning with the great toe. Similar deposits of urates may occur in other tissues in the course of time, and certain organs of the body are liable to become the seat of functional disorders or of pathological changes during the progress of the disease; this is *non-articular* or irregular gout.

"Gout usually begins as an acute affection occurring in fits; but subsequently tends to become chronic and permanent, though presenting exacerbations from time to time. The gouty diathesis may, however, be present without giving rise to any joint affection or other evident organic mischief. It is now generally admitted that the morbific agent producing it is uric acid, which accumulates in the system in abnormal quantities, due to imperfect elimination by the kidneys or molecular destruction, and this excess produces gout. It exists as lithate or urate of soda, which is distributed by the circulation to all the tissues of the body. In health the amount of uric acid in the blood is so minute that it cannot be detected by ordinary tests; but in gouty persons it can readily be obtained from any and all the secretions and tissues, and can be crystallized from the blood serum during severe attacks of the disease. Deposits of the urates, especially soda, are formed in the joints and other structures, and gout is the only disease in which these deposits are formed, and which are sometimes thrown off through the skin.

"Gout is one of the most striking examples of an hereditary disease, and once established it may be transmitted for several generations, and is generally intensified in progress by the continuance of the pernicious habits which induced it, thereby becoming a permanent legacy. Garrod found that in more than half his cases hereditary taint could be traced distinctly. It sometimes happens that, when gout becomes developed *de novo* in an individual, children born previously to its appearance are free from it, and those born subsequently

are liable to be affected. Hereditary influence may be so powerful that gout arises without any other cause whatever; but most commonly this is aided by the habits which first led to its development. The law of atavism sometimes also operates where a generation is missed, and the disease reappears subsequently. Should the predisposition be very powerful, the complaint may appear even in children, and the younger the subject who is attacked with gout the more likely is there to be an hereditary taint.

"The principal cause of gout *de novo* is excessive indulgence in nitrogenous foods and alcoholic drinks, and deficient exercise with indolent habits, and it is largely confined to the upper and luxurious classes in England.

"Gout is exceedingly rare under twenty years, unless strongly hereditary, and is rare before thirty, the majority of cases occurring between thirty-five and forty-five, usually appearing before fifty, and very rarely occurring after sixty. Males are more frequently the subjects than females, this being due to difference of habits, and also, according to some writers, to the eliminating effects of menstruation, for when it does appear in females it is usually after the cessation of this function. But when strongly hereditary, gout may appear in young females also.

"Gout must be distinguished from acute or chronic rheumatism or rheumatic arthritis, although it is a related disease. Rheumatism occurs in earlier life, and is common to both sexes."

From the writings of those who have investigated the subject of gouty teeth, the following selections will give us a fair idea of what has been done in that direction:

Dr. Dyce Duckworth, in an elaborate article upon the characters of the arthritic diathesis, says, "London appears to be the headquarters or center of gout, and more pure, unequivocal gouty disease is observed in this country than anywhere else in the world.

"I believe that there is a basic arthritic habit of body or diathesis, and that from this issue at least two branches,—the gouty and rheumatic. These two are not convertible,—cannot produce each other,—but they commingle. In regard to the teeth, the primary dentition is usually satisfactory, and not different from that of healthy children. My experience is different from Dr. Alfred Carpenter, in that the teeth of gouty patients are not subject to caries. Among three hundred hospital patients who were the subjects of inherited gout in varying degree, I found the teeth were remarkably strong, well enameled, and free from decay. Laycock taught this

twenty-five years ago, as has his pupil, Mr. Jonathan Hutchinson, and also Mr. Colsen. I find the teeth unusually large and regular in the arthritic diathesis; the edges smooth in the permanent set, not crenated. There is a tendency for one or more of the incisors in the lawer jaw to be pushed forward, which Laycock called 'buck teeth,' but I do not think this is confined to this particular habit, as any teeth are apt to rotate in their sockets in later life and protrude. Children of this diathesis are apt to grind their teeth during sleep, and persist in the habit to adult life, when it is done with such force as to chip and break the enamel. The enamel is usually yellow—white teeth being uncommon—and the color will deepen in time. They are vigorous and firmly planted, and extraction is difficult. The texture of the dental tissues is abnormally hard, yet the teeth are apt to wear down on the articulating faces. There is a disposition to tartar, which often collects in large quantities. Perfectly sound teeth are apt to be shed as age advances, as illustrated in several instances. Indeed, one case, a man of twenty-six, became prematurely edentulous, as did others. Mingled with other diatheses,—syphilitic, scrofulous, tuberculous, rheumatic, etc.,—the gouty habit presents corresponding peculiar phases. In America unequivocal gout is rarely seen, and then is usually mixed with the rheumatic diathesis, as this disease is endemic there."

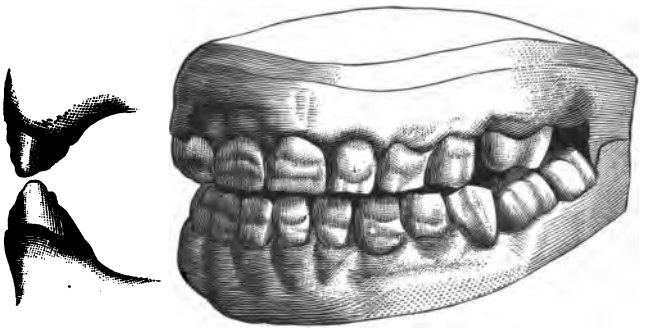
Dr. Alfred Carpenter says, "The effects of the gouty diathesis do not show themselves so markedly upon the teeth in early life, as is the case with the syphilitic and tubercular states. It manifests itself in another way, and other tissues suffer more than the teeth, though caries is not uncommon. It is a disease of later life, so that the progeny of gouty persons are usually born before the humors have been affected in the parent. The constitution is not thoroughly gouty before forty, and men do not have many children after forty. So the children inheriting a gouty diathesis are rare. Still, I think it is a fact that the teeth of such do decay early. This disease has its origin in fatty degeneration of the dental cells, and the subjects of it are especially liable to those peridental inflammations which ultimately lead to necrosis. Gouty persons also suffer from neuralgias and other conditions which have their origin in a lithic acid diathesis, which is often accompanied by pain, which reflects itself upon every function of the body."

Dr. W. Stewart took casts of the teeth of eleven gouty patients. In all the teeth were thick and solid and worn below the edges.

Mr. Fothergill said "these teeth had been first described by Dr.

Laycock, of Edinburgh. In these casts the teeth presented a resemblance to those descriptions that was unmistakable. They were all solid teeth. The wearing down was probably due to the presence of uric acid in the saliva." Mr. Sewill thought that "while the teeth were not pathognomonic, they were sufficiently pronounced to form an aid in diagnosis."

Dr. Horatio Dorkin writes that "Dr. Graves, in 1836, described the connection between grinding teeth in the sleep and the gouty diathesis, and explained it as being due to an irritable condition of the dental nerves. I know of eight children, the whole family, whose father has frequent attacks of gout, acute and seemingly acquired, and the mother's mother and grandfather suffered from the same disease. These children grind their teeth incessantly at night, and have done so all their lives. They all cut their teeth



at an early age, having had generally two and some four teeth at three months. In several of the children the teeth are worn. Some of them are also somnambulists and sleep-walkers. Most of them are nervous, and suffer from epistaxis. The two eldest have corneal ulcers. The teeth of all are characteristic."

In view, therefore, of the interesting scientific history given to this disease, especially in regard to its effects in producing teeth which are truly pathognomonic, it was with considerable interest that the writer discovered a case of gout in this country which is genuinely characteristic, and which has an authentic history. The patient is a woman of thirty or more now, of arthritic diathesis, and anemic from gout and rheumatism. The family is English, of course, for the case is imported and is not an indigenous product. Gout has been in both branches of the family for several generations, and the children inherit it directly. They have suffered from it from infancy, as this patient does yet.

Casts of the teeth of the case are herewith submitted, and it is noticed that the characteristics are pronounced. The teeth are short, thick in all directions, with heavy shoulders upon the lingual sides, and all very dark, solid, square, dense, and hard. The markings consist of transverse or encircling grooves or terraces, which give the teeth a step-like appearance. These grooves are perhaps characteristic, and are not to be confused with various kinds of grooves which mark the teeth affected by retarded development from different causes. The gums are light and thin, and present thin margins against the necks of the teeth.

But it is only the anterior teeth that are attacked, and the bicuspids are but slightly marked. The first molars were presumably affected, but some of them are now absent. The other molars are normal and present no peculiarities of shape, but the history of an extraction as given by the patient leaves little doubt but that the teeth possess all the other characteristics, especially the difficulty of extracting, which is a regular accompaniment of the diathesis.

Very recently Mr. Milner Fothergill says: "There is little doubt but that the configuration of the teeth in gout has a distinct value. The teeth are solid, and in the 'Norse' type—massive. They are blunt and thick at the edges and worn down. They have a great tendency to come out without any caries, but from osteitis extending from the neck along the fang. The incisors are more worn down than the cuspids or molars are. The center of the tooth is more of a dark color. When a gouty person shows the teeth they are at once to be detected. The gum is much retracted. Sometimes the upper front teeth are very massive." This description can well be applied to the cast before us of gouty teeth in all characteristics,—early wearing of the edges, the retracted gum, etc.

DISCUSSION.

DR. INGERSOLL: What explanation can you offer of the term hereditary disease?

DR. THOMPSON: I mean inherited disease,—*i. e.*, transmitted from parent to child. That is briefly all the explanation there is to it. Disease is inherited just as directly and positively as form, feature, or temperament.

DR. INGERSOLL: I doubt very much that disease is transmitted. We talk about consumption and a variety of diseases being inherited. I question the propriety of any such expression. I can understand

that diathesis or tendency to such and such pathological conditions may be transmitted. As an example, I knew a gentleman in early life who had upon the top of his head a wart, which was developed when he was about forty years of age. He had a son who, at about forty years of age, had a wart in precisely the same locality. I understand by that the tendency in the child to a development of its father's peculiarities. How often is it the case that whole families grow up in apparently vigorous health, without the slightest sign of pulmonary disease in early life, who die one after another at the age of fifteen or twenty or thirty or forty, the whole family dying at nearly the same age, showing an inherited tendency, but not inherited disease? I have no doubt about the importance of this question with reference to all classes of diseases, not excepting those of the teeth. I believe that the parent is the type of the child in every fiber of every tissue, and that there is no diathesis which is not subject to inheritance; not that decay is inherited, but that the peculiar tendency to decay may be inherited and may develop at certain periods of life. I have observed this in a great many instances. I was filling a tooth of a young lady of about seventeen, a lateral incisor, upon the anterior approximal surface. While I was filling the tooth I said, "I believe I have filled the corresponding tooth for your brother." "Yes," she said, "you also filled the corresponding tooth in my sister's mouth. My father and two of my uncles have lost theirs." The decay itself was not inherited, but at a certain period of life it developed in the mouths of one after the other of the family.

A lady, a noted singer, came to my office for treatment of the disease that is now falsely termed pyorrhea alveolaris,—the old term, *peripyema*, I like better,—and while she was in the chair she said, "I am extremely anxious about this tooth, for my brother has lost his, my sister has one in a worse condition than mine, and I am afraid I shall lose mine." The tooth was not at all decayed, but was very loose. An attorney came to my office with an excessive wasting of the gum and alveolar process of the lower incisors. He said, "I am going to lose them,—I know I shall, for my father and my grandfather lost theirs in the same way."

Such cases illustrate the inherited tendency of which I have been speaking.

DR. MORGAN: I think my friend, Dr. Ingersoll, has been playing upon words a little. How often you find the son the exact type in his mental make-up of the father. Is that not inherited, or is there

just a tendency in that direction? This stamping of the character of the parent upon the children is called, among horsemen, *prepotency*, and it depends upon the nervous organization much more than upon the physical. It requires a strong, positive nervous organization to make the transmission. In 1836 Justin Morgan brought an animal into Vermont. His descendants have been crossed and crossed until 1886, and I can show you in my neighborhood now animals possessing the same qualities that the original horse did, the same character of temper, the same power to endure, and the same gait, when there is scarcely a drop of the original blood in the animal. I think there is an inheritance in that direction. It is true, as he states, that disease itself is not transmitted, but the tendency to it is. With reference to the subject of diseases that manifest themselves upon the gum and tongue, I would say that a few years ago a physician in my city who was suffering from these aphthous ulcers upon the gum and cheeks, I found, upon examination, to have six or eight quite soft amalgam fillings in his mouth. I had frequent occasion to treat the ulcers, and I found they were always in the locality of the fillings. I replaced the amalgam fillings with gold, and his trouble was entirely cured. That is the only case I have seen in a practice of forty years. These ulcers are usually the result of some depraved condition of the fluids of the body. That there is a parasite concerned in their production I have no sort of doubt. The very fact that they almost universally yield to arsenical treatment satisfies me that there is some parasite concerned in their production. Many cases may be relieved by arsenical waters. The very worst cases of what is known as nursing sore mouth may be relieved by arsenical treatment if there is a moderate condition of health, so that I take it that that disease is the result of a germ, either present in the mouth or in the general organism, which makes itself locally manifest, and this germ may be destroyed by arsenic. Cancer it is hardly worth while to discuss, but it may be remarked that such ulcers are greatly aggravated by the habit of smoking, and men who have treated such cases universally deny their patients the use of the pipe or the cigar during treatment. Two celebrated cases have occurred among our public men within the last year that have attracted universal attention. In the case of a prominent man in my city it was feared the disease would develop in the same direction, but it was arrested by early treatment. In this case, a wisdom-tooth that had been worn down so that it presented a very sharp angle against the tongue caused great irritation, which was aggra-

vated by the use of a very strong pipe. A rigid course of treatment, with which I was not familiar,—for I was only called upon to treat the tooth,—relieved the gentleman, and he is still alive. I only know that arsenic was one of the remedies used. In cities where young people are confined in manufacturing establishments, and deprived of out-door exercise and pure air, you will find this disease manifesting itself much more frequently than among the rural population, or among those who are accustomed to out-door, active life; and especially in the malarial districts wherever the inhabitants show a little fullness of the stomach or abdomen, with cadaverous faces, you will find that there is great manifestation of this disease.

DR. BROPHY: I wish to say a word upon the subject of the disease that Dr. Smith has spoken of as cancer. I think we meet it more frequently in its incipiency than some of us are aware. It has been my lot to see a number of cases within the past few years, and I have found nearly always, where they were supposed to have been aggravated by smoking, that the teeth were worn, sharp, and jagged, and had lacerated the tissues, permitting the action of the nicotine, or perhaps some other element of the tobacco or other irritant, to come in contact with the parts and excite them to an extent which promoted an outgrowth of new tissue having no physiological purpose, and which resulted in the development of that species of cancer termed epithelioma.

Twice during the past year I have removed a section of the lower lip for the cure of epithelioma. Once, four years ago, I made the same operation, taking away about one-third or nearly one-half of the lower lip, and there has been as yet no recurrence of the disease. I feel pretty well satisfied in my own mind that epithelioma is a local affection; but if permitted to go on without treatment it develops into that malignant condition which soon terminates in death. Within the last month I have removed an epithelioma on the left side of the lower jaw, which had its origin, I am convinced, in a broken tooth upon that side. The tooth was extracted, and yet the disease continued to develop. In operating, I thoroughly removed the affected parts, as I thought. The second and third molars were removed, together with about one-half of the body of the lower maxilla on the left side. The parts seemed to heal very kindly, but in the case of the last tooth, the third molar, I failed to remove the very terminus of the socket, and here, a few weeks later, a little red jutting out of cells seemed to form that looked quite angry. By means of a scraper I removed not only this inflamed

tissue but the bone in contact with it, and so far it has not returned. This convinced me that the pericementum and all of the periosteum in immediate contact with these parts, or indeed for quite a little territory about them, ought to be thoroughly removed. After operating upon these tumors, I have almost invariably used chromic acid for the purpose of destroying any diseased tissues which may have been left. I believe that when these operations are made properly the prospect of prolonging the patient's life for a number of years is very good, and in the case I referred to first, which I operated upon three or four years ago, I believe there will be no recurrence of the disease. This form of cancer, if it may be called cancer, develops very fast. One case that I have in mind reached the size of a hickory-nut inside of three weeks from the time it first made its appearance. Some gentlemen may say that the individual had within him the tendency toward the formation of these tumors and toward the development of epithelioma, and that they would have occurred if there had not been any source of irritation, but that is simply an assumption, something we do not know anything about. It seems to me that this disease is on the increase, but those who have been devoting much time to the study of the subject tell us that such is not the case, and hold that it was as prevalent many years ago as at the present time.

DR. OTTOFY: I wish to call attention to the paper read by Dr. How in this Section with reference to the natural condition of the saliva. I think that all authorities agree that the saliva in its normal condition is or ought to be alkaline, but dentists who conduct examinations, as a general rule, find at the chair that this is not the case. This is an important matter. In all the examinations I have made I have found a large percentage acid and a large number neutral, and only a very small percentage alkaline. If the active principle of the saliva is intended to exert the influence upon food which I believe it does exert, it is of importance that it should be alkaline when mingled with the food. That apparently is not the case with a large number of people. The food and saliva are in contact so short a time in the mouth before passing into the stomach that its action must be rapid. Where the saliva is entirely acid, it certainly is of no consequence whether food has been insalivated or not. Another reason why we should determine the physiological condition of the saliva is as to its relation to decay. It would facilitate the settlement of the question whether the germ theory has as much to do with caries as some think it has. Dr. How has some blanks here

which he is willing to give away to members so that these examinations may be conducted in the office. It seems to me very important that such observations should be made in sufficiently large numbers to certainly establish beyond the slightest doubt what the normal reaction of saliva is.

DR. HARLAN: It seems to me that, with our present knowledge of the germ theory of disease, the explanation of the acidity of the saliva may be found in the products of the germs. The recent experiments of Dr. Black, of Jacksonville, Ill., have shown conclusively that quite a large number of germs are acid-producers, and that they and their products become mingled with the saliva. If germs cause the saliva to have an acid reaction, what is the natural method of correcting or avoiding that? It seems easy enough. If we keep the mouth clean, free from germs, food, and the chemical products of decomposition, there will be no destruction from acid.

Dr. Smith's paper upon diseases of the tongue was very timely. Too little attention is paid by oral surgeons and dentists particularly to the condition of the tongue. This member is quite as essential, I fancy, to the individual as the teeth. Otherwise we would not have such a great number of distinguished orators in this body. The tongue is subject to disease, and it is a fearfully disgusting, dirty member in the mouths of many people, who should learn how to keep it clean. The tongue inevitably becomes the subject of disease if this care is not observed, or if the teeth are allowed to decay or to become coated with tartar. I think that there are very few gentlemen in this audience who ever attempt to treat any, even the simplest, lesions of the tongue, except perhaps those of syphilitic origin. Why is this? It is because they say, "Oh, this is not my province; the little diminutive organ (tooth) that is at the other end of my excavator is the boundary of my horizon;" and hence pay no attention to it. Many times people not having their attention called to the condition of the tongue suffer a loss or a partial loss of this organ. Therefore, I think it necessary that we should give greater attention to diseases of this nature. I personally do not believe that tobacco has the slightest effect in producing carcinoma, but that the initial lesion is acquired from other causes. That tobacco may assist in prolonging or keeping up the irritation after once the process is begun, perhaps is true.

Gouty teeth or the tendency to the development of gouty teeth, or the hereditary transmission of the taint, has been referred to. The leisurely class in the United States of America is very small.

The great proportion of men are so intensely occupied in this country that few of them ever acquire gout. Their minds will not allow it. Many dentists and physicians and lawyers are dyspeptic. Dyspeptics do not become gouty, as a rule. So the generation that is to follow us, or the second or third from the present time, is not likely to inherit a tendency to gouty teeth. It will be two hundred or three hundred years before that will come around, and as the schoolmaster in Ohio said, we will "let posterity take care of itself." But we will teach it how to avoid the effects of heredity that *are* likely to prove disastrous.

Dr. James Truman: I was surprised to hear the statement made that in the largest proportion of mouths the saliva was of an acid character. I have been in the habit of testing the oral secretions for quite a number of years, and my experience and observations are directly the opposite. The secretions of the mouth, according to these, are almost invariably neutral. I allude now to the combined fluids and not the reaction given as they enter the mouth from the glands. The secretions give an acid response only under certain conditions. That fermentation and increased development of germ-life contribute largely to this change there can be no doubt, and a prominent factor in aid of this is absolute rest. This is found in all depressions and on all approximal surfaces. In this fact lies the foundation of dental caries. I have given very considerable attention to the matter, and the investigations I have been able to make have abundantly justified the conclusion as stated. When, therefore, do we have the greatest amount of rest in the mouth during the twenty-four hours? The answer would naturally be, during the period of sleep. The secretions in the largest number of cases are limited in quantity. The result is a marked increase of acidity at this period. This opinion is based on tests made in the same mouths at various periods, and particularly at night, immediately after a long sleep. This acid condition accounts for much that has been unexplainable by the ordinary theories of caries. I allude to abrasion, erosion, etc. It will also throw much light on some other obscure matters,—the absence, for instance, of an acid reaction in cavities during periods of greatest activity, while the destruction of tissue continues. I am satisfied that any theory of caries that fails to take into consideration the periods of partial or absolute cessation of the flow of the fluids will be unsatisfactory.

Dr. Atkinson: Iam so happy that I hardly know where to begin. I congratulate myself and the society upon the fact that they have

begun to deal with scientific matters. So far as the records go we are in the deepest kind of a muddle for the want of alphabetical arrangement of the means of pronouncing stages of production, nutrition, and destruction of the elements of tissues. In one word, it is a matter of education. Molecules are educated, and if molecules lie at the base and are the first points of the stored radiancy by which all action takes place, we ought at least to stick one stake that we need not take up. I am aware of the complications, the difficulties in which we are, by reason of very earnest seekers for the truth in molecular changes having pronounced what they saw as finalities, and being led to mistake the alternation of conditions of foresteps in protoplasm, throughout all the modifications of the exercise and combination of stored energy by which we classify this embodiment of that energy in the ratio of their simplicity and complexity in the educational condition, the registry of which has been called heredity. Every man has spoken from his stand-point, and it would require more time and patience and preparation of mind than the members of this body possess, to even tolerate the tabulation of the alphabetical statement that we must comprehend and utilize before we are masters of infection and contagion, life and death. I hear it on every hand that microbes are the immediate cause of disease. They are the antecedents of unhealth. I did not hear anybody say that any microbes were the antecedents of health. If microbes in their retrogressive activities bring about the disturbance of molecular change in living, sentient bodies, that we call disease, shall we forget that it was this very alternation of agents from micrococci all the way up that laid the possibility of the longevity of the beautiful organism that we call the human body? We are beginning to be a little bit awake to the fact that there is something that we have not yet comprehended, and that no one has even attempted to denominate, that is, efficient cause. O, how I tremble when I hear my brethren say "cause." We know nothing but antecedent and sequent. We do not know causes, and it is a misnomer to say we do. Where is our difficulty? My beloved friend from Kansas is a beautiful embodiment of many beautiful categories of a stored radiancy, but how he is tangled with his nomenclature. How many protoplasms did he give us? An indefinite number. Protos, *first;* and plasma, *mould of, an image.* Can there be but one protoplasm in the beginning sense? He did not tell us how protoplasm was rotated out of something that was before it in the organism into that heterogeneous homogeneity that we call pabulum, that is distributed throughout the

system and is the food of all the tissues. Had we studied these a little more closely we should have understood a little better that it was not this particular little house in which the embodiment of energy displays the metamorphosis in the combining of molecules and their breaking up, and the aggregation of these into corpuscles, and these into tissues, and these into organs, and these into systems, and these into the embodiment of consciousness that operates the whole. We say the liver secretes bile. Bile is secreted in the liver. We say the salivary glands secrete saliva. Let us get rid of false nomination and throw aside these embryonal facts that are but the foresteps to arrive at what we are trying to pronounce, that which is going on in the mind of every investigator, so that we can in our investigations communicate to others the mental processes through which we ourselves were *carried*. I had nearly condemned myself, and said "we *went*." That is just where I am, all over full of mental scars by reason of my reverence for my teachers. They say reverence is a good quality. So it is if we carry it high enough; but to reverence, that which is irreverent is just worshipping a lie. How do molecules of water come into existence from two gases? Was there the molecule in existence before it was in existence? Yes and no. It was in *esse*, as an eternal verity, without beginning and without end, H_2O. What brought H_2O together so as to reduce it from gaseous to liquid form? The high priest that awakened the affinity to combine resident in these atoms. I give you that because that is the simple one, and that is the process that is repeated all the way through, and when you come to get at how actions do take place you will not use multiplying combinations and call them single ones, by which you are continually getting tangled. The desire for combination and the energy to be combined existing in the hydrogen and the oxygen being awakened by a current of electricity, passed through the positive to the negative pole, arouses, engages, and marries these atoms into molecules; and that is the first step, and we call water the universal solvent. When we get into such a mass condition as saliva, gastric juice, intestinal juice,—that is, chyme and chyle and blood,—and then carry it through the system and resolve it into pabulum and into protoplasm, and then into embryonal corpuscles, we have the little bricks to build all the rest of the tissues. And they talk as if one food were necessary for the brain, and another food for another part of the body. It is no such thing. If you have that heterogeneous homogeneity that we call pabulum, that is the complete embodiment of the stored radiancy in the various foods that we use, the power that

they receive from the sun being held in them, and the acquisition of satisfaction, the quietness, the sleepiness being produced in that pabulum carries that pabulum anywhere into the territory of needy tissue, and the affinities will express themselves by something that we want by their own name, and I dare not name it now, although I have acquired some cheek by the confidence you have given me in listening. I tell you that listening in your mind is exactly equivalent to that asking that we call earnest desire to bring us together so that we can get a mental grip of the first steps of what we are about. We think we do it ourselves. So we think the liver secretes bile, and the same all the range through. If we would be delivered from the false nomination and get hold of the fact that it was simply feeding, first mentally and then bodily, and that digestion going on clear through all the embodiment of radiant energy in the measures that shall constitute the various bodies that we call by the names by which all of us have called them throughout, then we begin to get a grip of something, so that when we should say to a gentleman investigating the question of pyorrhea alveolaris that the first step of deterioration was destruction of the connective-tissue corpuscles, he would not turn in your face and say that the paper on pyorrhea alveolaris remains to be written. That is what Harlan had the audacity to say to me, after I had given him an elaborate paper upon the subject. If he had smelled even the aroma of the breaking of the cell in the skin of the subject, he could never have said that. He has got too level a head, but he is not educated up to the point. That is what ails us, as well as the molecules. We are not walking together, because we want to go as Adam did, when he said "I am alone." Our Irish girl said there would have been no trouble in this world if Adam had not said he was alone. We do not see how little the *ego* is until it has been combined with another *ego*. That is why I am so happy to-night, and so proud of this body. We ought to get rid of this abominable election of the president every year, that consumes so much time and energy in our body, and get somebody in the chair who will govern us honestly all the way through. We should elect a man who would stay with us ten years. You may tell me that is getting away from the subject. We want to run away from hell as fast as we can. What do you want with your placenta and cord and all that? Do you want to have it stuck up with fuss and feathers, and walk through the streets and say, "See what a beautiful thing my mother gave me?"

DR. THOMPSON: I believe that diathesis, cachexia, idiosyncrasy,

and what-not abnormal conditions, are but diseases attenuated; and to distinguish between diseases and predispositions of various kinds we need to consider them as varying only in quantity, but not in kind; that is, diseases are transmitted as disease; diatheses are transmitted as attenuated diseased conditions, which will light up into active disease on provocation, or on the attainment of a certain age; or predisposition or idiosyncrasy to certain disease is transmitted as a still further attenuated form of disease, and which may never become anything worse, if the favorable conditions for its further development do not arrive.

Dr. Ingersoll knows that infants are born with syphilis; syphilis is transmitted directly in a virulent form. He knows, too, that tubercle is transmitted as a latent disease, which will in time develop, and that other diseases are transmitted directly as impressions or predispositions. But the subject is too vast, and I only wish to insist that diathesis, predisposition, etc., are but disease attenuated or latent.

DR. ATKINSON: I would like to ask Dr. Thompson if he ever saw tubercle in any germ?

DR. THOMPSON: The impression is transmitted. Of course the tubercle itself is not, but the latent germ is in the ovum, and it will incubate and develop.

VOLUNTARY PAPERS.

Amalgam and Dental Alloys.—A Series of Experiments, with Deductions Therefrom.

BY A. MORSMAN.

I WISH to consider first the action of the metals (tin, silver, copper, gold, and zinc,) in their pure state, with mercury, as amalgams, as a possible explanation of their action when alloyed with one another.

1st Experiment. Filings of pure tin amalgamated with mercury. Ready amalgamation; soft, buttery, plastic mass. Continued soft and workable with the fingers for several hours. The mass never set so as to become hard, and could be readily fractured and crushed between the fingers.

2d Experiment. Filings of pure silver amalgamated with mercury. A very difficult amalgamation, a granular feeling under the fingers; never plastic even with surplus mercury; did not harden perceptibly in four weeks. Both tin and silver file with difficulty, because soft; clog the file very badly. Silver is worse in this respect than tin.

3d Experiment. Filings of pure gold amalgamated with mercury. Amalgamates with great difficulty, giving a peculiar crackling noise as it is worked, that is markedly different from the crepitus of other amalgams. With all surplus mercury squeezed out, it required twelve hours to harden, and was then made plastic again by the heat of the hand. In twelve hours more it was hard, but could be crushed with the finger-nail. It never became any harder.

4th Experiment. Filings of pure copper amalgamated with mercury. Very obstinate and slow to dissolve; granular, soft, without plasticity; showed no tendency to harden in twelve hours. In twenty-

four hours it was somewhat hardened, but could be readily crushed with the finger-nail. It never became harder.

5th Experiment. Filings of zinc amalgamated with mercury. Very difficult to amalgamate, granular, no plasticity, no crepitus. In forty minutes it had hardened considerably, but could be scraped with the finger-nail. In four hours it would take a burnish and retain it.

In reviewing this first series of experiments, it is seen that with the exceptions of gold and zinc these metals do not form crystallizable amalgams. Now, when it is borne in mind that our alloys are based upon formulæ which comprise essentially tin and silver, neither of which alone forms crystallizable amalgam, it will be seen that some change takes place when these metals are alloyed with each other. Heretofore I have believed that dental alloys were merely mixtures and not compounds,—I mean in the chemical sense,—but after a great many experiments I am induced to believe that silver when alloyed with other metals forms definite chemical compounds, and that our alloys consist of mixtures of these compounds with the other elements that are in excess. That is, if for instance an alloy of tin and silver be made with tin in excess, the silver unites with the tin until it is saturated and the remaining excess of tin is uncombined, but is mechanically retained in the ingot. This theory has been broached before, but never proved, and I am unable to prove it. In fact, I cannot say yet that I accept it, but the action of these alloys with mercury is indicative of such a condition. There is much opposed to this theory, and I only draw attention to it that it may be borne in mind while we review the experiments that are to follow.

It may be well to explain that I make an alloy in thefollowing manner: A sufficient quantity of borax is first fused in a crucible, then the most fusible metal is melted, and the others added in the order of their melting points. This is Prof. Flagg's method. All alloys were cut with files of the same fineness, so that the effect in filing could be observed. All filings were allowed to "age" for four months.

6th Experiment. An alloy of silver 90 parts and copper 10 parts —coin silver was taken. Ingot very hard; can be battered with a hammer, but does not break easily; bends before breaking; crystalline cleavage; files hard, but does not clog the file; filings grayish white; amalgamates with difficulty; granular feel; set in one hour and forty minutes sufficiently hard to take and retain a burnish.

7th Experiment. An alloy was made of silver 90 parts and tin 10

parts. Ingot cuts soft, and filings are coarse and bulky; clogs file badly; color same as above; very hard to amalgamate; takes up large quantities of mercury; grainy feel; works soft, but no cohesion of particles; loud crunching under the packing instrument. In forty-eight hours it could still be dented with a lead-pencil. Hardened after several days.

8th Experiment. An alloy made of silver 90 parts and zinc 10 parts. Files like the copper alloy and amalgamates about the same. Resembled in action the preceding alloy.

9th Experiment. An alloy was made of tin 90 parts and silver 10 parts. Ingot bends, giving the "cry of tin;" clogs the file badly; filings grayish, much darker than those of previous experiment, but in bulk about the same; amalgamates readily into a buttery mass with a somewhat greasy feel; set in about ten hours sufficiently hard to take and retain a burnish. Had no strength.

10th Experiment. An alloy was made of silver 80 parts and tin 20 parts. Ingot fractures readily, with crystalline cleavage; does not clog file badly; amalgamates readily; granular feel, not much cohesion of particles; set in an hour and forty minutes.

11th Experiment. An alloy was made of tin 90 parts and zinc 10 parts. Ingot cuts easily, clogs file somewhat, but not very badly; amalgamates readily, making a soft mass that works like butter or soft putty. This amalgam has a strong metallic taste. It set in twenty-four hours, but had no strength. It was, however, an actual setting, resembling a low-grade silver alloy.

12th Experiment. An alloy was made of tin 90 parts and copper 10 parts. Ingot cuts similar to the preceding; amalgam not so greasy in feel; it did not set at all.

13th Experiment. An alloy was made of tin 80 parts and zinc 20 parts. Same as No. 11, but set more quickly and had a little more strength.

14th Experiment. An alloy of tin 90 parts and pure gold 10 parts was made. It acted exactly like pure tin in all respects. I could not detect any difference.

In reviewing this series, we note, first, that two metals, neither of which produce crystallizable amalgams, may do so when alloyed. Second, that ten per cent. of tin would not make a crystallizable amalgam alloy with silver, but that twenty per cent. of tin made it harden in one hour and forty minutes; and that ten per cent. of copper made an alloy with silver that set in the same time as the twenty per cent. tin alloy. Third, ten per cent. of silver was suffi-

cient to make a crystallizable amalgam with tin, that set in ten hours. Of the two metals, silver and tin, the latter required less alloying to make a crystallizable amalgam than the former. A comparison of the ten per cent. copper alloy and the twenty per cent. tin alloy shows marked differences, although they set in the same time. The copper alloy is hard, firm, and takes a good polish. The tin alloy is not very hard, and does not take a good polish easily. Fourth, zinc is the only one of these metals besides silver that forms a crystallizable amalgam alloy with tin, and that only faintly. Gold has no effect. Fifth, that silver can be alloyed with tin, copper, zinc, and gold, and the resulting amalgam with mercury will crystallize.

My third series of experiments, which I am about to detail, was made to determine whether shrinkage and expansion were properties chargeable to the alloy or to the amalgam. I have long believed the latter, and have looked upon "tube tests" as indicating but little regarding the alloy, and this series of experiments was made with the view of demonstrating, if possible, how much the alloy was responsible for these faults.

Preliminaries. An alloy which I call "No. 10," being the tenth of a series of formulæ which I have tried in practical work, was taken as the basis of the experiments. This alloy consists of silver 50 parts, tin 45 parts, and copper 5 parts. At the time of making the experiments it had been cut six months and was in nice working order. The glass tubes were of the same size and calibre (cut from the same piece), and to avoid touching them with the fingers a wooden holder was made with a socket for the tube to stand in. In the center of this socket was a wooden piston which entered the tube to nearly the end (one-fourth of an inch), against the end of which the amalgam was packed. The tube was thus held firmly and a cavity was formed about one-fourth of an inch deep, and with the end of the piston forming the bottom. The temperature of the room was maintained at 70 degrees F. After the tubes were packed they were allowed to harden before placing in the bath of colored liquid to determine leakage. Considering that the end of the tube first packed would naturally contain the least mercury, owing to the pressure in packing, I tested each end of the plug separately, by first filling the tube with the solution, which tested the end first packed, and then immersing the tube, which tested both ends.

15th Experiment. Amalgam made of "No. 10" with very little

mercury. When amalgamated it was a dry, black powder; this was carefully packed in a tube with hot instruments. Tube filled with a solution of aniline in water stood ten days,—no leakage. Tube immersed in the solution,—slight leakage at margin of plug on the end last packed.

16th Experiment. Same alloy mixed "plastic," just in good working condition. Packed in tube in same manner as above, except that the surplus mercury as it came to the surface of the plug under the instrument, was wiped off with a pellet of cotton. Tube filled with colored fluid for ten days,—no leakage; immersed for ten days,—a very trifling leakage at the end of the tube last packed.

17th Experiment. Same alloy mixed "soft" with excess of mercury, which was allowed to absorb instead of being removed. Tube filled with colored fluid ten days leaked very badly. No trial by immersing.

18th Experiment. Same alloy mixed "soft," and the surplus mercury squeezed out by the greatest possible pressure between the thumb and fingers. This is done as follows: the soft mass is squeezed hard and then transferred to the palm of the hand and manipulated until it is again soft, when it is again squeezed. This is repeated three or four times until it is dry. No mercury was removed from the mass in packing. Tube filled with colored fluid ten days,—no leakage; immersed ten days,—slight leakage at end last packed.

19th Experiment. Same alloy mixed "soft" and squeezed dry by placing in a chamois skin and twisting it. The last end of the plug was "wafered." Tube stood filled ten days,—no leakage; immersed ten days,—very trifling leakage at end last packed.

20th Experiment. Same as above, except that the amalgam was placed in chamois skin and squeezed as dry as possible with pliers. No leakage on either trial.

In reviewing the third series of experiments, we have to note first, that the end first packed leaked only in one instance, and that in that instance mercury was greatly in excess; second, that the filling containing the least mercury was the best; and third, that it made no difference in the result how the mercury was eliminated, or whether it was ever there, so that there was no surplus left in the plug. Squeezing amalgam has been condemned, according to these experiments, without good grounds. They show also how the same alloy can be amalgamated so as to shrink, or so as not to shrink. It remains to demonstate that the alloy being very different

the amalgam can still be made non-shrinking. Partly to demonstrate this, and also with the view of determining as nearly as might be the best binary alloy for amalgam, the fourth series of experiments was instituted.

Believing, from the preceding experiments and six years' practical work, during which time I have used none but alloys of my own make or of known formulæ, that silver and tin were the only elements of value in dental alloys, aside from therapeutic effects, the series was exclusively confined to combinations of these two metals.

Preliminary Considerations. The alloys were all carefully made in exactly the same manner. They were cut with the same file, and were of the same "age." The "tube tests" were made under the same conditions as prevailed in the preceding series, packing each test so as to get the best possible results. I had no method of testing "edge-strength," except by breaking upon the thumb-nail, but the buttons were made uniform by packing in a mold. The recorded time of setting is, of course, only for comparative purposes, the mass being of the same size, and the "mix" the same as far as possible. The color test is also comparative,—a solution of potassæ sulphuret, forty grains to the ounce,—the buttons being immersed at night and removed the next morning.

21st Experiment. An alloy was made which we will designate "A." It was composed of 90 parts pure silver to 10 parts pure tin. Ingot resembles silver, but not nearly so white; bends before breaking, crystalline cleavage; cuts soft and clogs file badly; filings coarse and bulky, very hard to amalgamate; takes up large quantity of mercury; grainy feel under the fingers, soils hands badly, works very soft but with no cohesion of particles; loud, crunching noise under the pestle; set very slowly; in forty-eight hours it could be dented with a lead-pencil. I did not examine it again for a week, when I found it hard. Tube filled ten days with colored fluid leaked badly. The tube was again packed and again tried. It did not leak; immersed ten days in colored fluid, leaked somewhat at end last packed. It was not again tried. Tested for edge-strength, at the end of forty-eight hours it had none whatever. It was not tried later.

22d Experiment. Alloy "B" was made. This was composed of pure silver 80 parts and pure tin 20 parts. Ingot grayish color; fractures readily, does not bend, crystalline cleavage; files much more readily than preceding, and does not clog file; filings grayish; amalgamates more readily than "A," and works better; set in one hour

and forty minutes sufficiently hard to take and retain a burnish. Tube filled 10 days with colored fluid,—no leakage; immersed 10 days,—no leakage. Edge-strength very poor.

23d Experiment. Alloy "C," composed of pure silver 70 parts and pure tin 30 parts. Ingot very hard and brittle, highly crystalline cleavage, crystalline structure visible without fracture; files hard and slowly into fine, dark gray granules; very small bulk in proportion to weight; amalgamates readily, with but little mercury, tendency to harden rapidly; set sufficiently hard in ten minutes to take and retain a burnish. Tube test, same as preceding; no leakage. Edge-strength excellent.

24th Experiment. Alloy "D," composed of pure silver 60 parts and pure tin 40 parts. Ingot and filings resemble so closely alloy "C," that the same description will apply; amalgamates readily and works nicely; set in 30 minutes sufficiently hard to take and retain a burnish. The first tube tests leaked badly, but were more carefully repacked and did not leak. Edge-strength very good.

25th Experiment. Alloy "E," composed of pure silver and pure tin, equal parts. Ingot hard, fractures readily, crystalline cleavage; files readily, does not clog file; filings resemble alloy "B;" amalgamates readily and works nicely; set in one hour. Tube tests same as in previous experiment,—no leakage. Edge-strength very good.

26th Experiment. Alloy "F," composed of 40 parts pure silver to 60 parts pure tin. No perceptible difference in character of ingot or filings from alloy "E;" amalgamates very rapidly, and works plastic; set in one hour and twenty-five minutes sufficiently hard to take and retain a burnish. Tube tests: slight leakage at both ends of plug at first trial. The tube was repacked and again tried,—no leakage. Edge-strength fairly good.

27th Experiment. Alloy "G," composed of pure silver 30 parts and pure tin 70 parts. Still no marked difference in the ingot; files soft and more rapidly; filings more bulky; ready amalgamation, plasticity marked; set in one hour and forty-five minutes. Tube tests, same as in previous experiments,—no leakage. Edge-strength not very good.

28th Experiment. Alloy "H," composed of pure silver 20 parts and pure tin 80 parts. Ingot white, bends before breaking, slightly crystalline cleavage; files easily, but clogs somewhat; filings coarse and bulky; amalgamates readily; buttery, greasy plasticity; set in two hours sufficiently hard to take and retain a burnish. Same tube tests applied,—no leakage. Edge-strength bad.

29th Experiment. Alloy "I," composed of pure silver 10 parts and pure tin 90 parts. Ingot resembles tin; bends, giving "cry of tin," no crystalline cleavage; files soft and clogs badly; filings bulky; amalgamates readily, with "buttery" feel; time of setting about 10 hours. It was mixed at 5 P. M., and at bed-time was not hard, but was set the next morning. At the first trial of the tube tests there was leakage. The test was not repeated. No edge-strength.

The color test was applied to all alike by polishing an amalgam button from each alloy, and dropping into the solution, as has been described. The gradations of color were proportionate to the quantity of silver in the alloy.

In reviewing this fourth series of experiments, we have to note, first, the very remarkable resemblance between the alloys at the extremes of the series. "A," which is nearly all silver, is much like "I," which is nearly all tin. The ingots are about the same in color. Both bend before breaking; both are slow-setting and without edge-strength. Both clog the file badly. "B" and "H" are also alike. The time of setting is nearly the same in both.

Beginning at the silver end of the series and examining the ingot, we find that it becomes rapidly harder, more brittle, and more crystalline as tin is added until alloy "C" is reached. Here we seem to have a new metal entirely, and one that has lost largely the characteristics of its constituents. This point is the apex of the series, so to speak, and as we continue to add tin the metal becomes soft again, but more gradually than it became hard, until "I" is reached, which resembles "A." And now note that this same relation exists, no matter what property we examine. Edge-strength increases rapidly up to "C," when it gradually declines. The time of setting is more than 48 hours at "A," it is ten minutes at "C," from which point it gradually increases to more than 6 hours at "I." *If there is* a chemical union of these two metals in melting or amalgamating, the point of saturation must be near that proportion represented by alloy "C." Certainly this point represents the culmination of the qualities sought by the amalgam worker, except, of course, discoloration, which I have shown to be proportionate to the silver in the alloy.

It is seen also that alloys of very different formulæ will make non-shrinking amalgams, and this in conjunction with what has been already shown proves conclusively, it seems to me, that shrinkage and expansion are properties of the amalgam, and not of the alloy.

The conclusions which I would draw from these experiments are:

First. No one alloy will fulfill all indications. The number required will be about four.

Second. The formulæ for these alloys should be approximately as follows: For a hard, quick-setting alloy for crown work, etc., or where color is not important, alloy "C" is the proper one to use, 70 silver and 30 tin. For a fairly good alloy, that will not discolor badly, and that does not set fast enough to interfere with manipulation,—a good alloy for general use,—the "E" formula, silver and tin equal parts, is an excellent one. I have tried it in practical work and like it better than any other. For an alloy in which color is the one important property, accompanied by reasonably good strength, alloy "G," which is silver 30 parts and tin 70 parts, is typical. The therapeutic effects of copper are often desirable. Such an alloy is well represented by "No. 10," which is silver 50 parts, tin 45 parts, and copper 5, or perhaps with still better effect, copper 10 parts. The metals must in all cases be pure.

Third. The manner of mixing and packing an amalgam is all-important. The less mercury left in the plug the better. But it is not necessary to work a dry amalgam. It is sufficient if the mercury be worked to the surface in packing and then removed. This indicates plainly the importance of the matrix in approximal amalgam work.

If operators would use only known alloys, and record their cases, we should soon be in possession of abundant facts bearing upon this subject.

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August, 1887.

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year.

1879	commencing	with	No. 1.
1880	"	"	No. II.
1881	"	"	No. III.
1882	"	"	No. IV.
1883	"	"	No. V.
1884	"	"	No. VI.
1885	"	"	No. VII.
1886	"	"	No. I.

Adopted 1879.

Resolved, That a paper presented to the Committee on Voluntary Essays and by them considered and returned to the writer with notification that the said paper is not accepted, cannot afterwards be read before the Association unless it is made the special order by resolution adopted.

Adopted 1885.

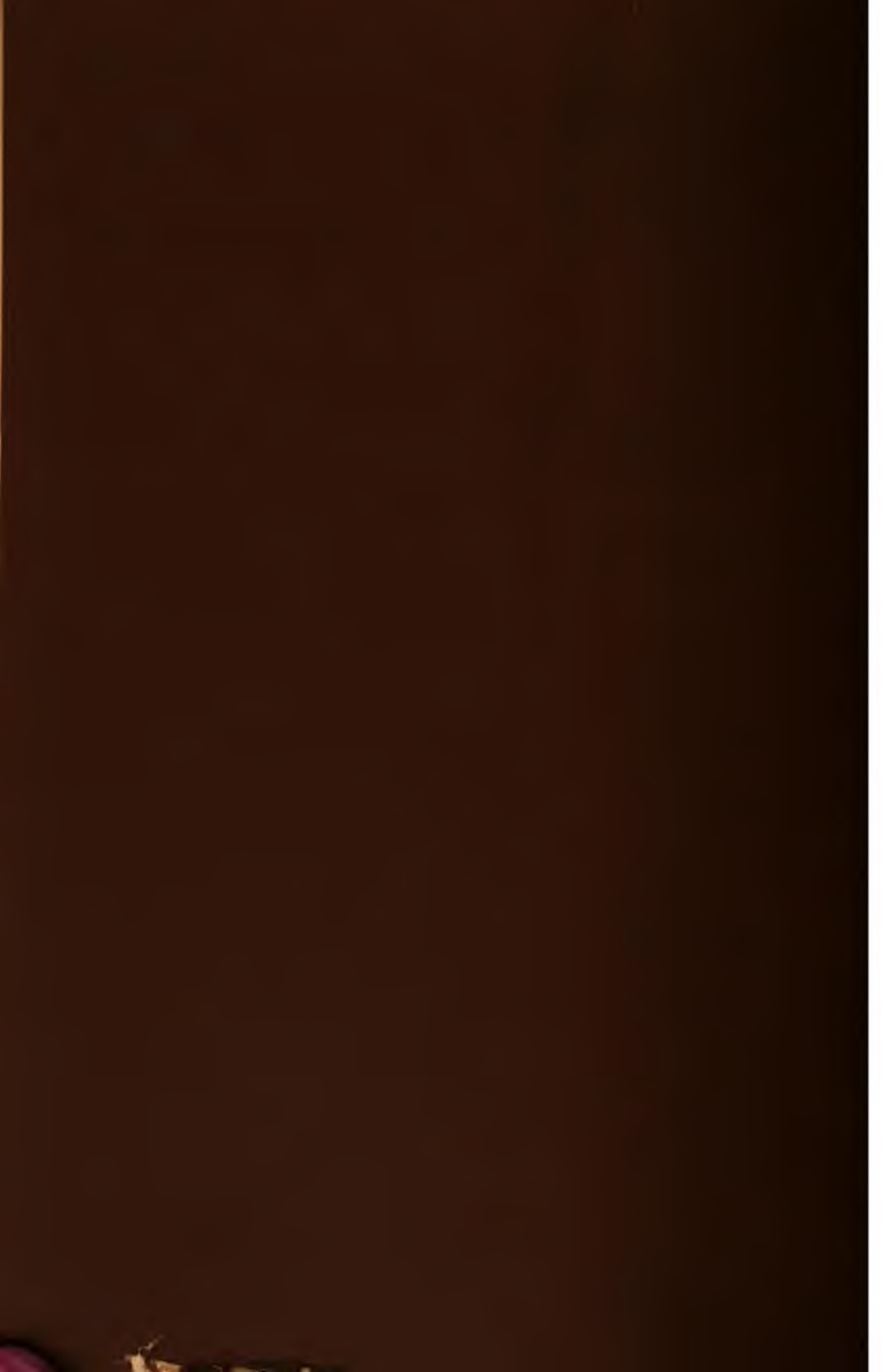
It shall be the duty of the Executive Committee of the Association to provide at the opening of each annual meeting a book for the registration of members or visitors as they arrive, which shall also give place of residence and hotel where each may be found.

Adopted 1886.

Resolved, That in the future this Association discountenance the giving of banquets, excursions, entertainments, etc., by local professional societies or individuals, either during or at the close of our annual meetings.

Adopted 1886.

Resolved, That it shall be the duty of the chairman of the Credentials Committee to procure and keep a book wherein each delegate who wishes to be considered a permanent member of this Association shall enter his name.

Adopted 1886.

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